PROPOSED WORK PLAN

REMEDIAL INVESTIGATION/FEASIBILITY STUDY

KOPPERS COMPANY, INC.

FORMER CAVALCADE PLANT SITE, HOUSTON, TEXAS

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FORMER CAVALCADE PLANT SITE, HOUSTON, TEXAS

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December 13, 1984

Document No. P-D452-100

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INTRODUCTION

This plan was prepared to define the scope of activities anticipated to accomplish a Remedial Investigation/Feasibility Study (RI/FS) for the Koppers Co. Inc. former Cavalcade plant site in Houston, Texas.

A. Objective

The primary objective of the RI/FS is to identify and characterize any threat to human health, welfare or the environment from the former Cavalcade plant site. Once the problem has been delineated, alternative source control(s) and/or offsite remedial action(s) will be developed and evaluated. The most cost-effective source control(s) and/or offsite remedial action(s), in accordance with the National Contingency Plan, will be recommended and a conceptual design of the control action(s) prepared. All tasks and subtasks are directed toward accomplishment of these primary objectives.

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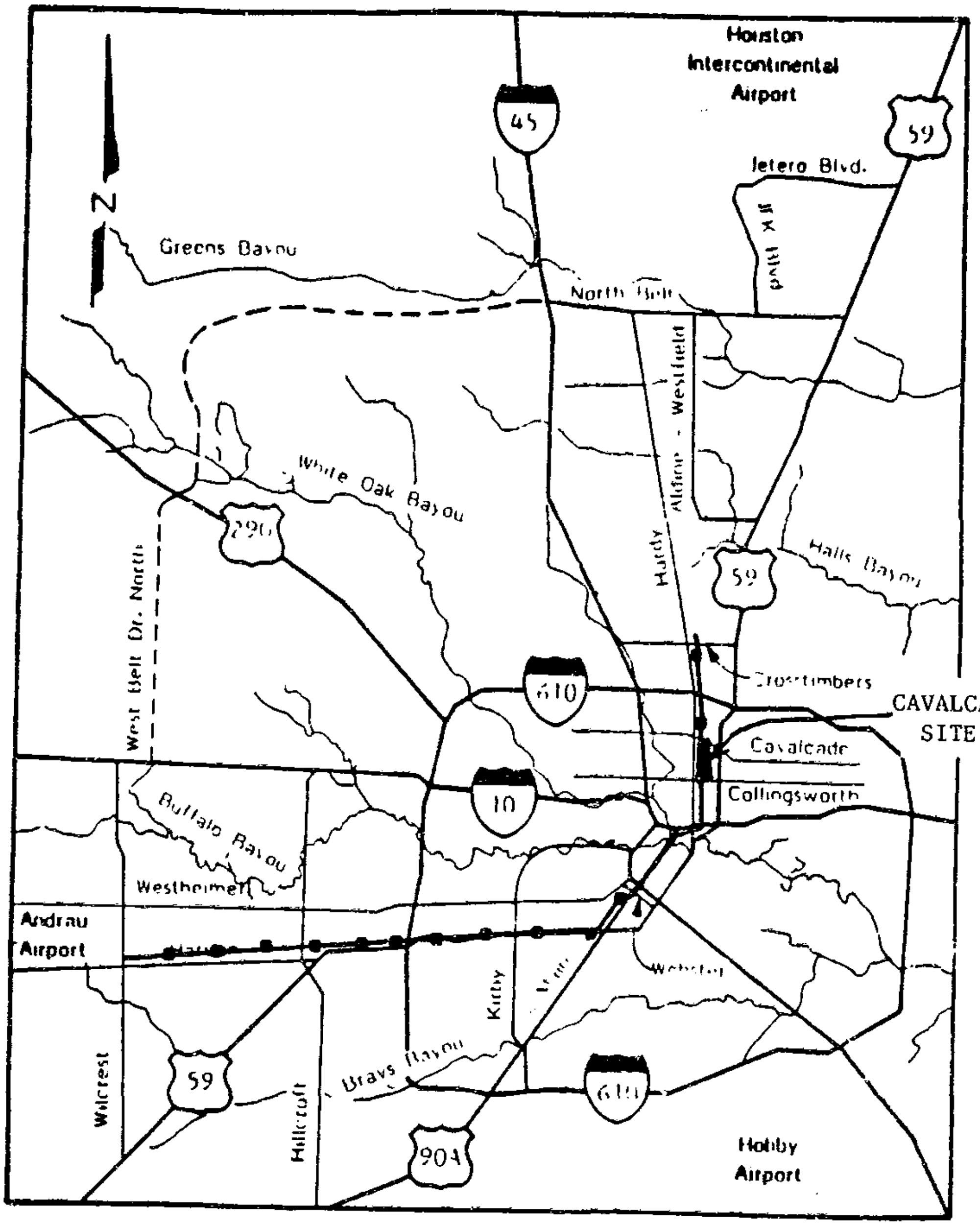
B. Background

Koppers Co. Inc. operated a wood treating plant and a coal tar distillation plant on Collingsworth Street in Houston, Texas, from 1940 until it was closed in 1962. Figure 1-1 displays the location of the former wood treating and tar plants. The site is bounded to the north by Cavalcade Street, to the south by Collingsworth Street, to the east and the west by the Houston Belt and Terminal Railroad. In 1962 the plant ceased operations, and the property was sold.

The present-day land use of the site is commercial in nature. The southern one-third of the site consists of two trucking firms, Merchants Fast Motor Lines and Palletized Trucking, Inc. This area constituted the former processing areas of the wood treating plant. Transcon Trucking Lines is operating at the northern one-third of the



LEGEND

Proposed alignment of METRO-Stage One, RRS

Proposed passenger stations
(CBD stations not shown)

Figure 1-1

Site Location Map

0 4 8 Miles

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site adjacent to Cavalcade Street on property owned by the Baptist Foundation of Texas. AJF Leasing, Inc. also operates as a sub-leasor on the Baptist Foundation property. An open field with no land development occupies the middle one-third of the site. Figure 1-2 details the present property owners for the site.

The geologic strata underlying the Cavalcade site consist principally of interbedded sands, silts, and clays of the Beaumont Formation. These sediments were deposited in fluvial (river) and deltaic environments during the Pleistocene Epoch. Clay and silt soils predominate in the upper 200 to 300 feet of the Beaumont Formation. Layers of sand frequently occur as thin, discontinuous deposits of rather limited extent. Thicker, more continuous sand deposits occur in the deeper parts of the Beaumont Formation and in the upper parts of the underlying Lissie Formation. However, based on published geologic reports, the Lissie Formation outcrops several miles north of the site area.

The Lissie Formation and the lower Beaumont Formation are commonly used sources of groundwater supplies in the Houston area, although their yields are generally considered too small for major exploitation. The deeper sands from the Chicot and Evangeline Aquifers, located over 1000 feet deep, are high yield aquifers used for major groundwater supplies.

The strata of the Beaumont Formation generally dip to the southeast towards the Gulf of Mexico. Thus, the sediments exposed at the surface become progressively younger toward the coast. The regional dip of the strata and the presence of the interbedding of the sands and clays result in considerable influence on the regional hydrogeology of the Houston area. Based on published geologic literature, the principal areas of groundwater recharge for the Chicot and Evangeline Aquifers (i.e., Lissie Formation) occur several miles north of the site area.

The predominance of clay and silt soils in the upper part of the Beaumont Formation and the southeastward dip of the geologic strata serve to act as a confining layer for the Chicot Aquifer. This

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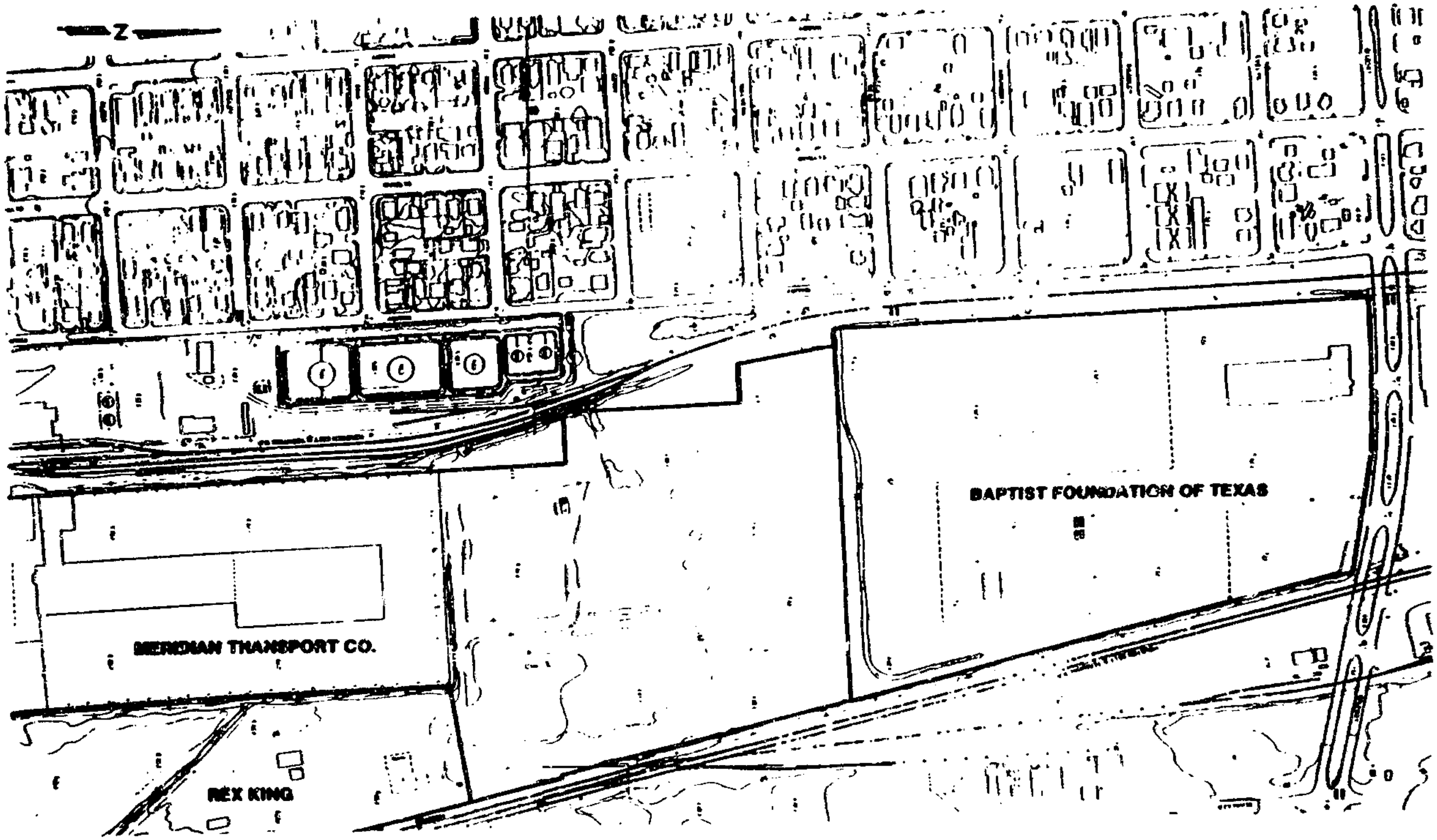

Figure 1-2

Present Property Owners of Site

produces artesian ground-water conditions in the Chicot Aquifer. The limited sand layers in the upper Beaumont Formation are considered too discontinuous to allow effective recharge to the deeper aquifers.

Past investigations at the Cavalcade site have identified localized areas of shallow soil and shallow groundwater contamination. CDM's evaluation of the shallowest aquifer currently known to be used for domestic groundwater supplies indicated that contaminants had not migrated into this aquifer. Limited evidence of previous wood preserving activities has been noted on the site, including piles of abandoned cross-ties and surficial soil stains.

C. Investigative Actions to Date

In 1982, McClelland Engineers performed a reconnaissance geotechnical survey for locating a maintenance and storage facility for the proposed METRO-Stage One, Regional Rail System on the old Koppers Cavalcade plant site. The McClelland study results included general soil conditions and preliminary foundation recommendations for the proposed facility layout.

During the investigation, creosote odors were detected by the field investigators at some of the boring locations. Several soil and groundwater samples were collected and subsequently analyzed for napthalene and phenanthrene. Based on these test results and on available aerial photographs, it was determined that the Cavalcade site was potentially contaminated with creosote wastes from past wood preserving operations. In December 1982, it was recommended that an additional investigation be performed to assess the extent of the contamination problem and its potential impact on development of the site.

Camp Dresser & McKee (CDM) was commissioned to perform a contaminant survey for the Cavalcade site. The results of their study are presented in a three volume report titled "Cavalcade Contaminant Survey". It presents the most comprehensive environmental data to date for the Cavalcade site. The major results and conclusions of the study are presented here in a summary form.

1. Hydrogeology

The soil borings conducted during the CDM investigation generally disclosed four distinct soil strata. Although there are some variations in strata elevation and thickness, the following generalized soil strata appear to be continuous throughout the site.

Stratum	Depth, ft	Description
I	0 - 2	Fill: Silty fine SAND
II	2 - 10	Soft to very stiff sandy CLAY and clayey SAND
III	10 - 20	Medium dense to very dense fine SAND
IV	20 - 80	Very stiff to hard CLAY and silty CLAY with sand and silt layers

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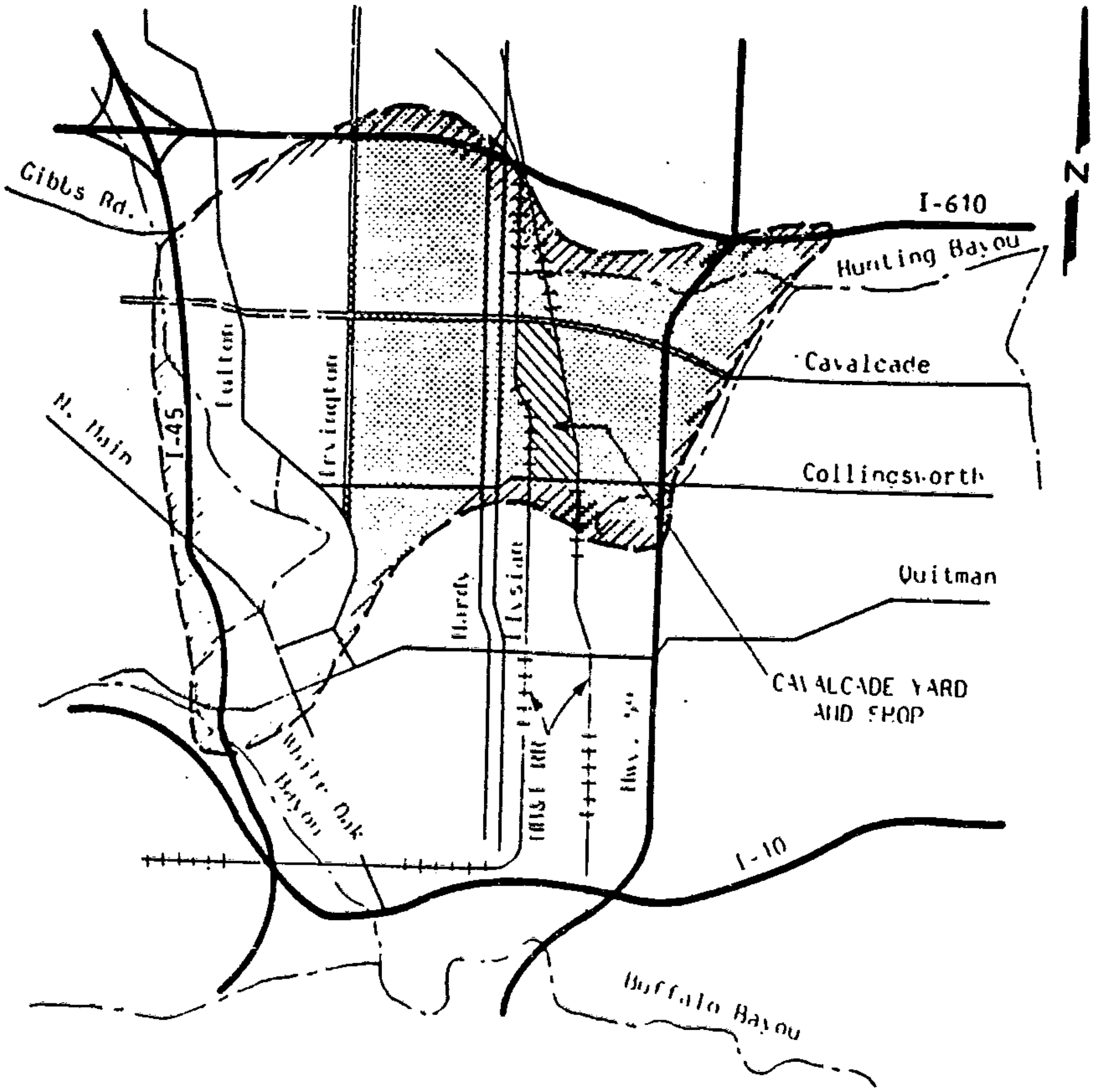
Stratum III consists of a shallow sand layer, typically located about 10 feet below ground surface. The thickness of the shallow sand layer varies across the site from about 5 to 10 feet. Based on the reconnaissance borings, the shallow sand layer appears to be present throughout the site. In addition, soil borings along Cavalcade Street indicate the shallow sand layer extends off-site. Figure 1-3 presents CDM's interpretation of the regional extent of the shallow sand layer in the area of the site. This illustration was prepared from information obtained from the Historical Study, Reconnaissance Study, Cavalcade borings, and Texas Department of Highway borings. The exact location of this sand layer was not identified and may therefore extend beyond the boundaries shown on Figure 1-3. The unshaded area shown on Figure 1-3 represents the portion of the shallow sand layers believed to extend west from Irvington Street, but not confirmed from the soil borings.



Note:
Shaded area indicates known areal extent of shallow sand layer, as determined through exploratory borings. Dashed line represents interpolated shallow sand layer area.

Figure 1-3

SHALLOW SAND LAYER LOCATION MAP

0 0.5 1 Mile

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2. Surface Drainage

Site surface drainage consists of two main features. The developed areas occupied by the trucking companies contain a system of ditches, storm water inlets and catch basins to convey runoff into the storm sewer system. The undeveloped portion of the site is poorly drained. Ditches are mainly located along the east and west property borders and parallel to the railroad lines. No significant drainage features are present throughout the interior of the undeveloped tract. The ground surface elevation throughout the site is about 52 feet. The average ground surface slope is less than 0.1 percent.

Little White Oak Bayou provides regional drainage to the west of the site and Hunting Bayou provides drainage to the east of the site. Figure 1-3 shows the approximate location of these two bayous. It can also be seen that the shallow sand layer present at the site appears to intersect both bayous. However, a hydraulic connection between the sand layer and the bayous has not yet been established.

Little White Oak Bayou trends along a general north-south direction about one mile west of the site. Little White Oak Bayou drains south to White Oak Bayou which empties into Buffalo Bayou. Hunting Bayou trends in a general east-west directon and is located about one-half mile east of the site. Both Buffalo Bayou and Hunting Bayou flow directly into the Houston Ship Channel.

3. Production Wells

An inventory of water wells located in the site vicinity was conducted by CDM to identify the locations of potential groundwater supplies. Several agencies were contacted for information, including the United States Geologic Survey, Texas Department of Water Resources, and the Harris-Galveston Coastal Subsidence District. Several wells were located within a two-mile radius of the site, although many of the records published by the agencies were found to be outdated and incomplete.

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Three common strata used for groundwater supplies in the site area were identified. The uppermost aquifer is located about 170 to 220 feet below ground surface. This formation does not have a high yield and is therefore primarily restricted to domestic use. The second aquifer is located approximately at depths of 450 to 600 feet. This aquifer is used mostly for industrial purposes. The third aquifer is located typically below 1000 feet and is used primarily as a drinking water supply for the City of Houston.

4. Historic Aerial Photos

A series of historic aerial photos are available for the Cavalcade site and have been reviewed by CDM, TDWR, U.S. EPA, Koppers and ERT. These photos are from 1933, 1944, 1953, 1957, 1961 and 1964. Based on these photos, five suspected potential waste disposal or concentrated contamination areas have been defined. These areas are shown in Figure 1-4 in relation to the current site uses and are described briefly below.

Area 1 appears to be a wastewater pond associated with a second wood preserving operation located north of present-day Cavalcade Street. This facility was not on Koppers property, was not operated by Koppers, and is not included in the scope of the required RI/FS.

Area 2 is a roughly rectangular area of about 170 x 110 feet located at the north end of the site within Koppers' former property line. The area first appears in the 1957 aerial photo. The nature of this area has not been determined definitively as yet, but it appears to have been a wastewater ponding or waste disposal area. This is indicated by the results of CDM borings and analyses in this area (see sections below).

Area 3 is identified in a 1951 plant drawing as a "pond". Although seen in the 1961 aerial photo, in the 1964 photo it has been covered by a paved parking area of the Meridan Transport Company. Company records indicate that this was a cooling pond.

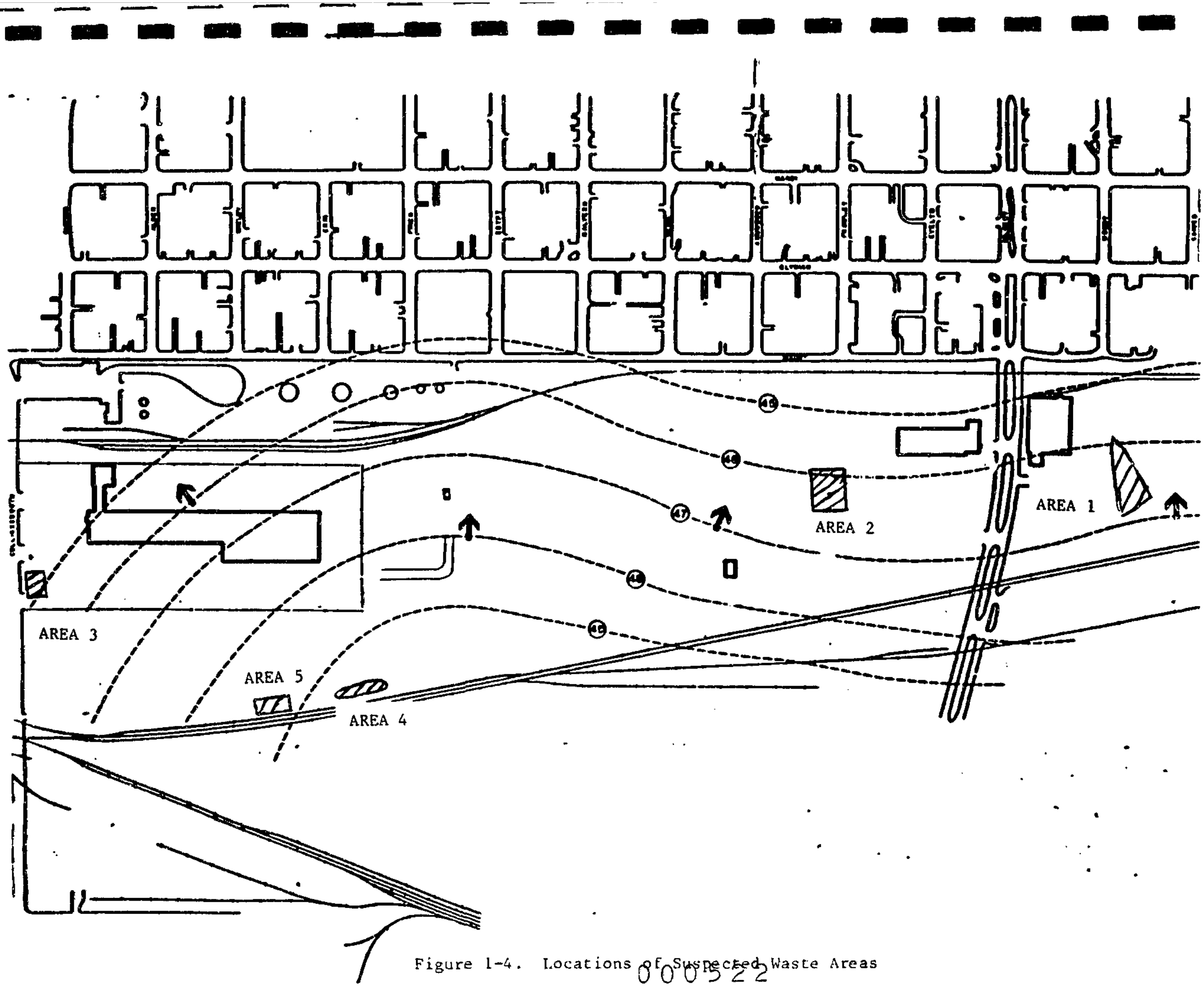

Figure 1-4. Locations of Suspected Waste Areas

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Area 4 appears beside an old concrete loading dock that handled products from the tar refinery. There is some visible evidence on site of residues from apparent spills and leaks in this area.

Area 5 has been identified as two spray ponds associated with the tar products plant. Old plant drawings indicate that the ponds were of concrete construction, measuring 40' x 50' x 4'6" and 36'8" x 53'6" x 4'6". There is no visible evidence of these ponds or their structures on site at present.

The historic aerial photos, and old plant drawings, are also useful in showing the former layout of the Koppers wood treating and tar products plants. The processing equipment (treating cylinders, working tanks, storage tanks) for the wood treating operation was located at the far south end of the property along Collingsworth Street. This area, and the drip tracks area, are now almost completely covered by thickly paved (6-10 inch) parking lots for the trucking operations conducted on the properties owned by Meridian Transport Co. and Rex King. The tar products plant was located along the eastern side of the site, just west of Areas 4 and 5 (Figure 1-4). This area is also almost completely covered now by parking lots.

5. Soil Borings

Subsurface soil samples were collected to characterize the depth of contamination and the structure of the underlying soil. No offsite samples were taken. The sampling interval consisted of continuous samples from ground surface to 10 feet below ground surface then at 5 foot intervals to 40 feet. For shallow depth holes (10 feet) samples were collected at 2.6 and 8 feet depths below the ground surface. Shallow samples were collected using rotary drill equipment and attaching a 3 inch thin wall, 2 feet long Shelby tube to the bottom of the drill string and pressing the tube into the soil at the bottom of the borehole. Figure 1-5 presents the locations of the soil borings and the sample analysis results. The previously identified disposal areas are contaminated with both organic and inorganic compounds at the surface, but the contamination is attenuated with depth. The decrease in concentration from the surface to the bottom of the boring

ANALYSIS RESULTS CAV-SL-03

SL-03 (All organic values PPB, ug/kg, all inorganic values PPM, mg/kg wet weight basis)

Volatile Organic Contaminants	01 (2)	02 (5)	03 (10)
Methylene chloride	59	40	31

Refractory Organic Contaminants	01	02	03
Acenaphthene	780.	ND	ND
Acenaphthylene	2400.	280.	ND
Anthracene	12000.	1900.	ND
Benzo(a)anthracene	32000.	5600.	ND
Benzo(a)pyrene	21000.	2000	ND
3,4-Benzofluoranthene	46000.	6400.	ND
Benzo(g,h,i)perylene	700.	1600.	ND
Benzo(k)fluoranthene	46000.	6800.	ND
Chrysene	42000.	6500.	ND
Fluoranthene	120000.	24000.	ND
Fluorene	580.	ND	ND
Indeno(1,2,3-c,d)pyrene	7200.	1900.	ND
Naphthalene	1000.	ND	ND
Phenanthrene	20000.	5800.	ND
Pyrene	110000.	20000.	ND

SL-03 Toxic Metal Contaminants	01 (2)	02 (5)	03 (10)
Arsenic (As)	82.0	1.5	0.33
Beryllium (Be)	0.20	0.20	0.20
Cadmium (Cd)	0.10	ND	ND
Chromium (Cr)	19.0	14.0	1.4
Copper (Cu)	21.0	1.9	1.3
Lead (Pb)	54.0	7.2	1.2
Mercury (Hg)	0.040	0.020	0.009
Nickel (Ni)	2.1	1.0	2.1
Silver (Ag)	0.20	ND	0.88
Thallium (Tl)	0.10	ND	ND
Zinc (Zn)	200.0	21.0	1.6

ANALYSIS RESULTS CAV-SL-04

SL-04 (all organic values PPB, ug/kg, all toxic metal values PPM mg/kg, wet weight basis)

Volatile Organic Contaminants	01 (2)	02 (5)	03 (10)	04 (15)
Ethylbenzene	160	98	10	ND
Methylene chloride	ND	52	11	ND

Refractory Organic Contaminants	01	02	03	04
Acenaphthene	100000.	160000.	80000.	540.
Acenaphthylene	3000	ND	3200.	ND
Anthracene	240000	520000.	48000.	580
Benzo(a)anthracene	17000.	21000.	28000.	120.
Benzo(a)pyrene	4600.	7600.	32000.	460.
3,4-Benzofluoranthene	10000.	16000.	7200.	140
Benzo(g,h,i)perylene	ND	ND	5000.	ND
Benzo(k)fluoranthene	10000.	16000.	7200.	140.
Chrysene	11000.	20000.	36000.	120.
Dibenzo(a,h)anthracene	ND	ND	5000.	ND
Fluoranthene	260000.	440000.	120000.	2000
Fluorene	80000.	110000.	64000.	140.
Indeno(1,2,3 c,d)pyrene	ND	ND	ND	ND
Naphthalene	160000	640000	200000	ND
Phenanthrene	240000	1000000	180000	4400
Pyrene	170000.	280000.	88000.	1400
2,4-Dimethylphenol	ND	ND	ND	ND

SL-04 Toxic Metal Contaminants	01 (2)	02 (5)	03 (10)	04 (20)
Arsenic	1.8	2.0	1.2	0.29
Beryllium	0.26	0.28	0.6	0.31
Cadmium	ND	ND	0.5	ND
Chromium	14.0	4.1	8.1	1.7
Copper	ND	0.56	7.7	1.2
Lead	1.4	0.37	9.1	6.4
Mercury	0.020	0.005	0.004	0.005
Nickel	2.3	1.70	15.0	4.50
Silver	ND	ND	1.2	ND
Zinc	15.0	21.0	24.0	5.8

ANALYSIS RESULTS CAV-SL-01&02

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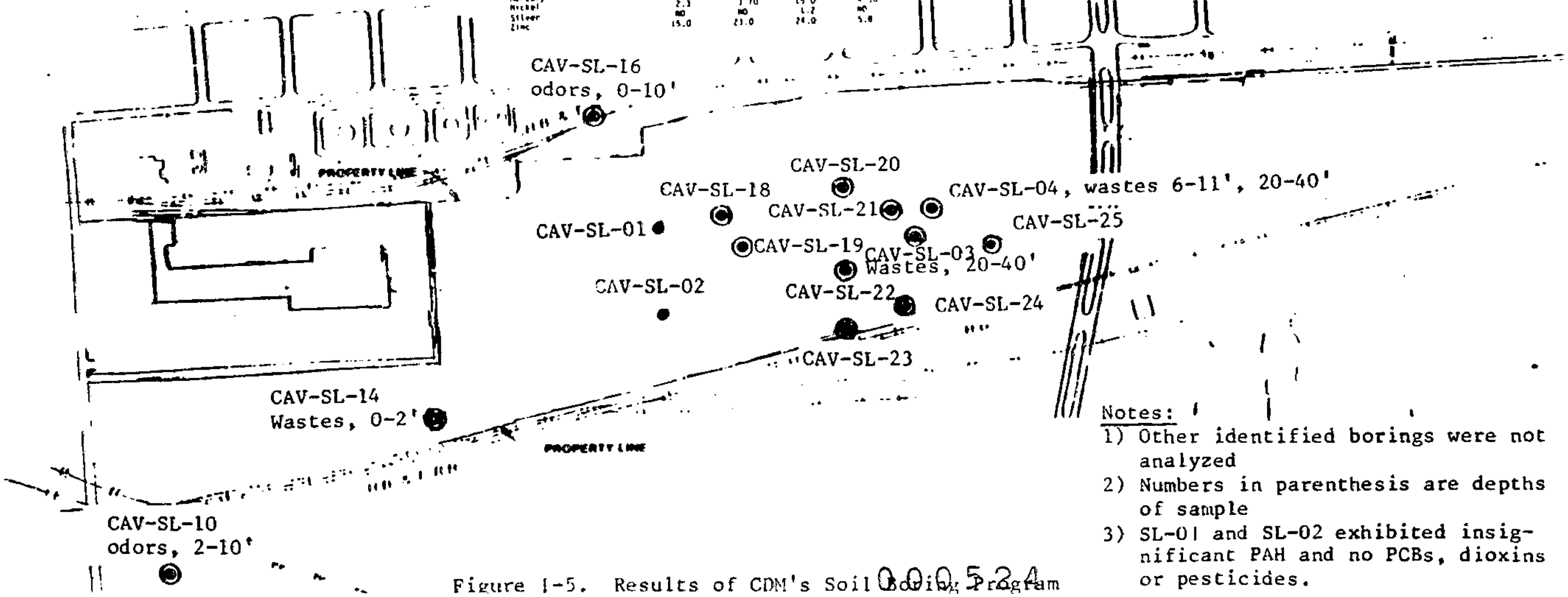

Notes:
1) Other identified borings were not analyzed
2) Numbers in parenthesis are depths of sample
3) SL-01 and SL-02 exhibited insignificant PAH and no PCBs, dioxins or pesticides.

Figure 1-5. Results of CDM's Soil Boring Program is by a factor of 100 for many of the polynuclear aromatic hydrocarbons (PAH) and volatile organic compounds. These findings indicate that if these contaminated materials were excavated and removed from the site, then the most significant source of groundwater contamination for this site would be gone.

CDM's soil boring program also provided useful data on visual and olfactory evidence of contamination in soils underlying the site. These observations are summarized in Figure 1-5 for the soil borings and Figure 1-6 for the monitoring well borings. In both cases, observations of soil contamination are limited to areas where contamination was otherwise known or suspected, viz., the vicinity of Area 2 (CAV-SL-03 and 04, CAV-OW-06 and 14), the former tar products plant area, including Areas 4 and 5 (CAV-SL-14 and CAV-OW-11), and the former wood treating processing area (CAV-OW-10). Odors in two borings along the site boundar.es (CAV-SL-10 and 16) are more likely the result of other sources in the area (e.g., fuel storage, railroad bed spills and drippage, other industries). It is noteworthy that borings in the middle and northern portions of the site, except in the vicinity of Area 2, which were formerly used for wood storage, had no signs of contamination noted.

6. Shallow Groundwater Sampling

Ten observation wells, nine shallow wells and one deeper aquifer well, were installed on the site south of Cavalcade Street. The primary purpose of the observation wells was to establish groundwater flow characteristics at the site. The planned groundwater monitoring program was not fully completed. Only five groundwater samples were analyzed, of which only two were from wells located south of Cavalcade Street. Figure 1-6 shows the approximate locations of the ten monitoring wells, as well as the available analytical results. Water level readings were taken over a period of five months and water level contours are also depicted in Figure 1-6. The single deep well, designated as CAV-OW-06, extended to a 200 feet deep sand aquifer known to be presently used for domestic water supplies. This is the shallowest known usable aquifer near the site.

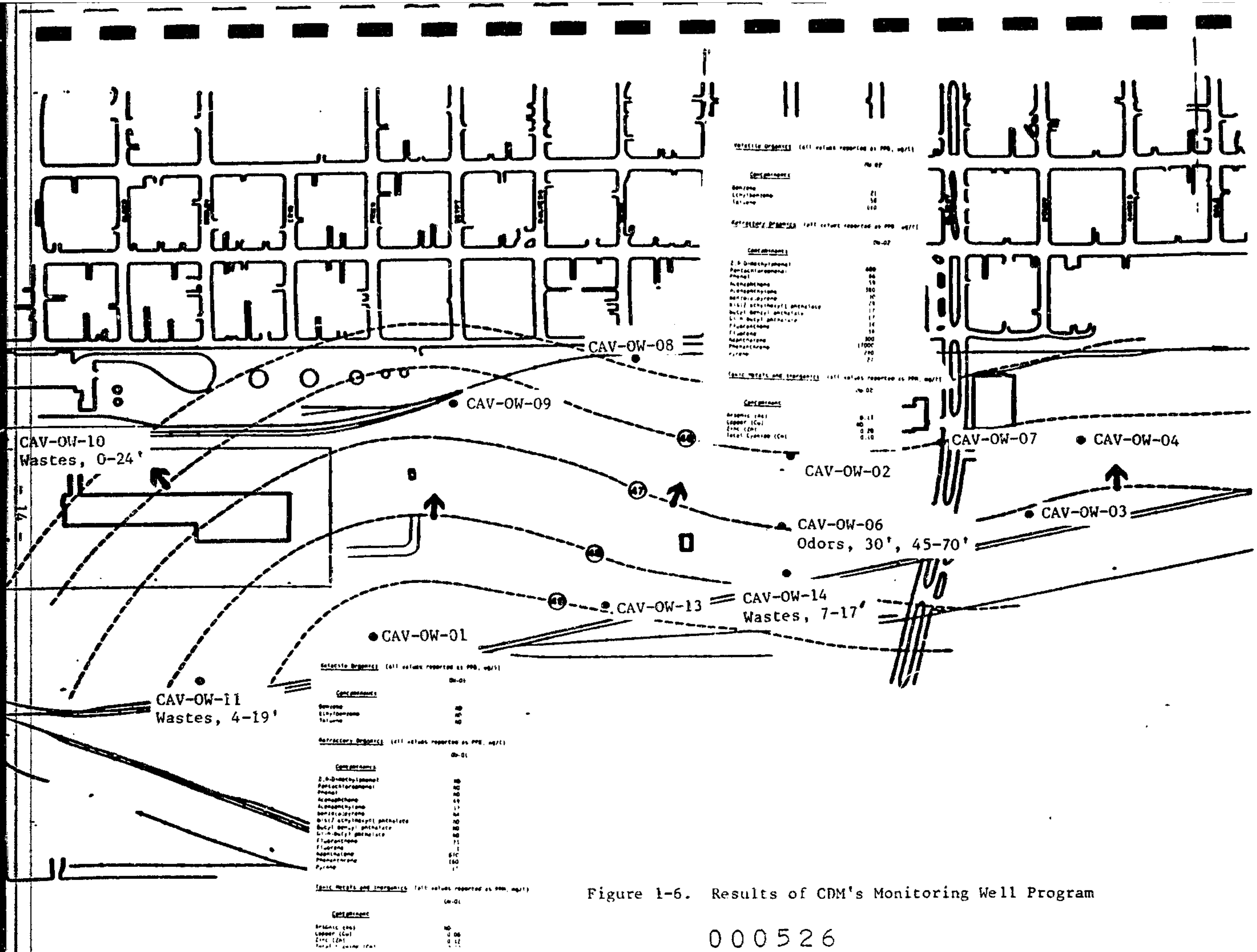

Figure 1-6. Results of CDM's Monitoring Well Program

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The organic contamination observed in the shallow groundwater is consistent with the surficial contamination associated with past disposal practices at the site, with the exception of the volatile organic compounds observed in CAV-OW-02. These aromatic hydrocarbons in the ratio detected are consistent with recent petroleum hydrocarbon (gasoline) contamination. The levels of toxic metals observed in the shallow aquifer are at or near EPA primary and secondary drinking water standards and pose no significant threat to health or the environment. The toxic metal contamination encountered in the surface soil samples is not reflected in the associated groundwater samples, indicating that the metals are not in a mobile form in the soil. The cyanide concentrations observed in wells CAV-OW-01 and 02 are believed to be from an offsite source. With the exception of trace concentrations of toluene (49 ppb), the deep aquifer well (CAV-OW-06) was uncontaminated by any priority pollutant organic compounds. Arsenic and selenium were present at concentrations near primary drinking water standards, however.

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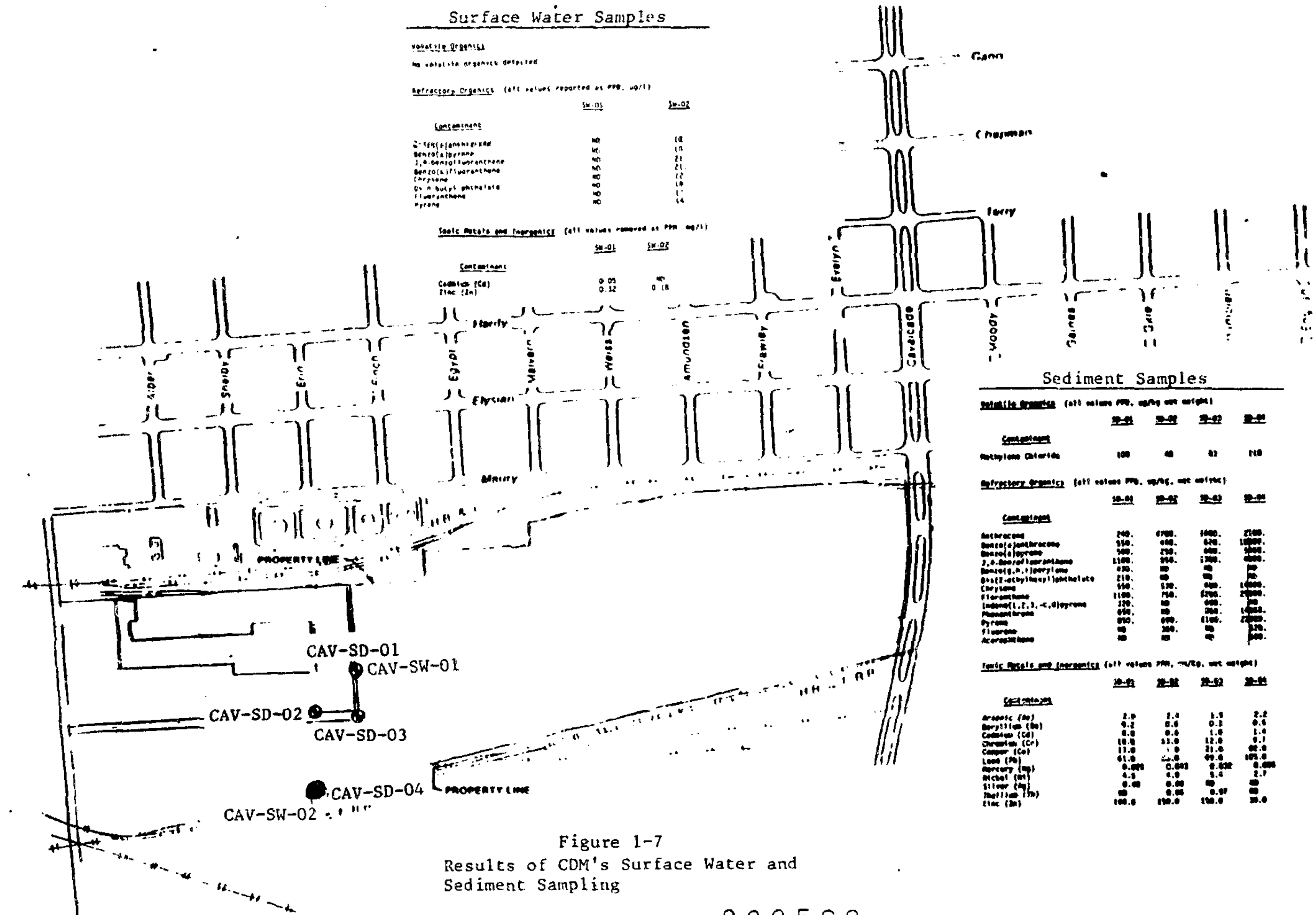
7. Surface Water and Sediment Sampling

Site runoff water and associated sediments were sampled by CDM in the drainage ditch around the Merchants Fast Motor Lines property and the ditch along the railroad tracks on the eastern boundary of the site (Figure 1-7). These samples were collected to establish general surface water quality in the vicinity and to determine any relationships between such quality and the various waste areas identified near the sampled drainage ditches. No offsite samples were collected.

The analytical results summarized in Figure 1-7 indicate low ppm levels of various PAH compounds and trace metals in the drainage ditch sediments, and low ppb levels in one of the water samples (railroad tracks ditch -- CAV-SW-02). These results are not unexpected given the current uses of the site and its locations in an urban/industrial area. The concentrations seen are not clearly indicative of contaminants from Koppers' former operations and do not pose significant health or environmental risks.



Surface Water Samples

Volatile Organics

No volatile organics detected

Refractory Organics (all values reported as PPB, ug/l)

Contaminant	SW-01	SW-02
2-Methylnaphthalene	ND	10
Benzo(a)pyrene	ND	10
3,4-Benzofluoranthene	ND	21
Benzo(k)fluoranthene	ND	21
Chrysene	ND	12
Di-n-butyl phthalate	ND	16
Fluoranthene	ND	[illegible]
Pyrene	ND	14

Toxic Metals and Inorganics (all values reported as PPM, mg/l)

Contaminant	SW-01	SW-02
Cadmium (Cd)	0.05	ND
Zinc (Zn)	0.12	0.18

Sediment Samples

Volatile Organics (all values PPB, ug/kg wet weight)

Contaminant	SD-01	SD-02	SD-03	SD-04
Methylene Chloride	100	40	83	110

Refractory Organics (all values PPB, ug/kg, wet weight)

Contaminant	SD-01	SD-02	SD-03	SD-04
Anthracene	240.	4700.	1000.	2100.
Benzo(a)anthracene	550.	440.	620.	10000.
Benzo(a)pyrene	500.	230.	600.	5000.
3,4-Benzofluoranthene	1100.	950.	1300.	4000.
Benzo(g,h,i)perylene	430.	ND	ND	ND
Bis(2-ethylhexyl)phthalate	210.	ND	ND	ND
Chrysene	550.	530.	900.	10000.
Fluoranthene	1100.	750.	5200.	20000.
Indeno(1,2,3,-c,d)pyrene	320.	ND	600.	ND
Phenanthrene	650.	ND	360.	14000.
Pyrene	890.	690.	1100.	22000.
Fluorene	ND	300.	ND	120.
Acenaphthene	ND	ND	ND	140.

Toxic Metals and Inorganics (all values PPM, mg/kg, wet weight)

Contaminant	SD-01	SD-02	SD-03	SD-04
Arsenic (As)	2.9	2.4	1.5	2.2
Beryllium (Be)	0.2	0.6	0.3	0.5
Cadmium (Cd)	0.0	0.6	1.0	1.4
Chromium (Cr)	10.0	11.0	12.0	9.1
Copper (Cu)	11.0	[illegible]	21.0	60.0
Lead (Pb)	61.0	[illegible]	49.0	105.0
Mercury (Hg)	0.095	0.083	0.032	0.086
Nickel (Ni)	4.5	4.0	5.4	2.7
Silver (Ag)	0.40	0.08	ND	ND
Thallium (Tl)	ND	0.36	0.97	ND
Zinc (Zn)	160.0	190.0	150.0	30.0

Figure 1-7
Results of CDM's Surface Water and Sediment Sampling

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8. Surface Soil Sampling

Surface or near-surface soil samples were collected at four locations and analyzed for priority pollutants. Figure 1-8 shows the sample locations and summarizes the results. The two samples collected from the open field area (CAV-SL-01 and -02) showed no significant contamination, with total PAH at 1 ppm or less and low ppm levels of various trace metals. The two samples collected from the former pond area (CAV-SL-03 and -04) showed clear signs of creosote contamination, with individual PAH concentrations typically exceeding 100 ppm. However, deeper samples from these borings showed that PAH concentrations decreased substantially at greater depths (see Figure 1-5).

D. Preliminary Assessment

A preliminary assessment of the probable impacts and likely potential remedial actions for the Cavalcade site was performed by Koppers and ERT based on the available site characterization data summarized above. This preliminary assessment, while its conclusions are tentative and need to be confirmed by an RI/FS, is valuable in providing focus and direction for the RI/FS work plan.

The two main areas of concern identified by a critical review of available site characterization data are 1) the potential impacts of visibly contaminated soils at or near the surface and 2) the extent and potential impacts of groundwater contamination resulting from the site. A preliminary assessment of the potential impacts for these areas and likely potential remedial actions, if warranted, are described below. Surface water impacts are not of concern at this site given its current condition, use and location, and the results of CDM's preliminary work in this area.

1. Soil Contamination

Areas of obvious, visual soil contamination on site are limited to Areas 2 and 4 (Figure 1-4). The potential impacts of contamination in these areas are their roles as continued groundwater contamination

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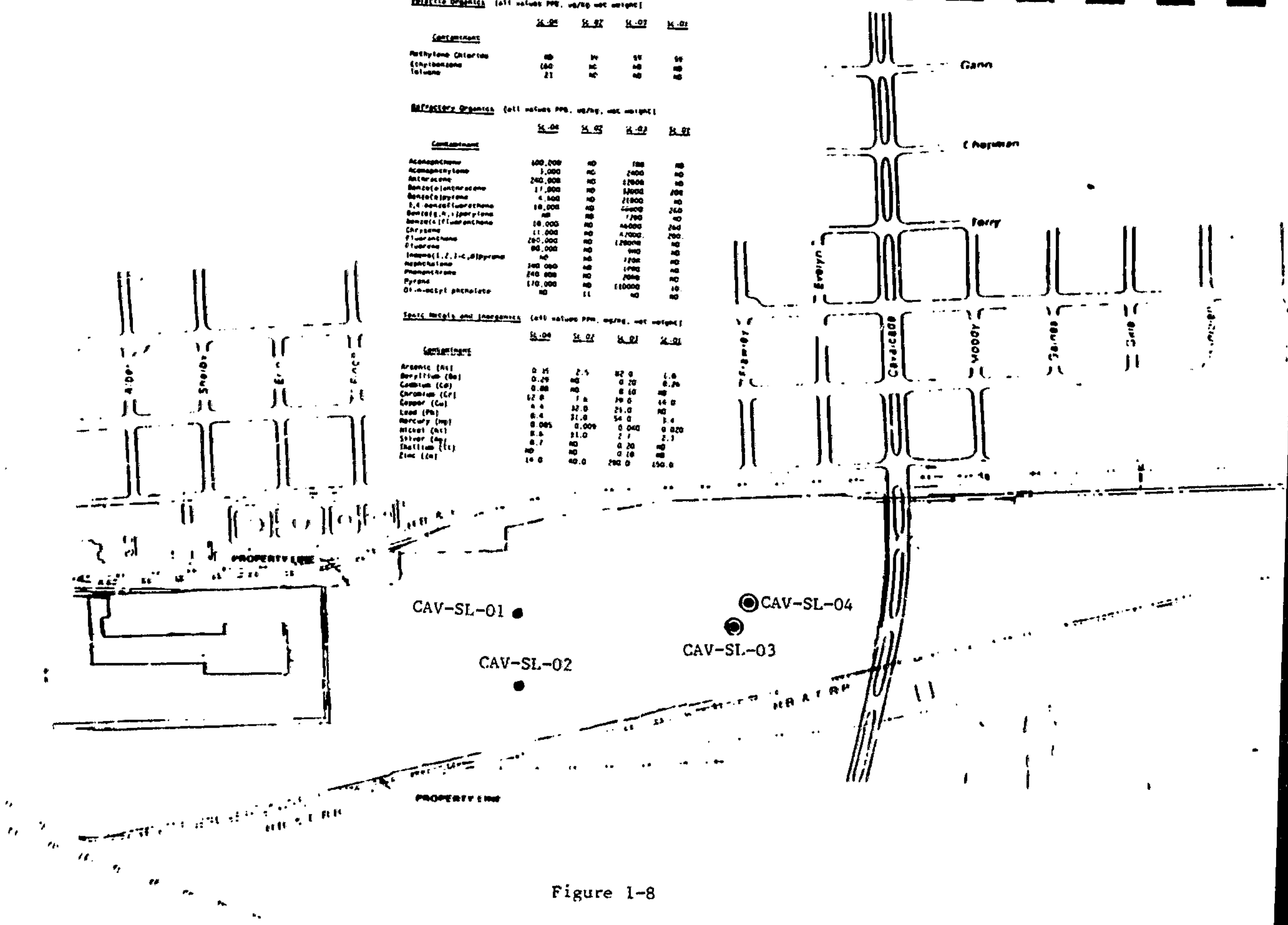

Volatile Organics (all values PPB, ug/kg wet weight)

Contaminant	SL-04	SL-02	SL-03	SL-01
Methylene Chloride	ND	[illegible]	97	94
Ethylbenzene	160	ND	ND	ND
Toluene	21	ND	ND	ND

Refractory Organics (all values PPB, ug/kg, wet weight)

Contaminant	SL-04	SL-02	SL-03	SL-01
Acenaphthene	400,000	ND	780	ND
Acenaphthylene	3,000	ND	2400	ND
Anthracene	240,000	ND	12000	ND
Benzo(a)anthracene	17,000	ND	13000	200
Benzo(a)pyrene	4,500	ND	21000	ND
3,4-benzofluoranthene	10,000	ND	44000	260
Benzo(g,h,i)perylene	ND	ND	7700	ND
Benzo(k)fluoranthene	18,000	ND	46000	260
Chrysene	11,000	ND	47000	200
Fluoranthene	280,000	ND	120000	ND
Fluorene	90,000	ND	990	ND
Indeno(1,2,3-c,d)pyrene	ND	ND	7700	ND
Naphthalene	340,000	ND	1900	ND
Phenanthrene	240,000	ND	2000	ND
Pyrene	170,000	ND	110000	10
Di-n-octyl phthalate	ND	11	ND	ND

Toxic Metals and Inorganics (all values PPM, mg/kg, wet weight)

Contaminant	SL-04	SL-02	SL-03	SL-01
Arsenic (As)	0.35	2.5	82.0	1.6
Beryllium (Be)	0.29	ND	0.20	0.26
Cadmium (Cd)	0.88	ND	8.60	ND
Chromium (Cr)	12.0	7.6	70.0	44.0
Copper (Cu)	4.4	32.0	21.0	ND
Lead (Pb)	6.4	31.0	54.0	3.4
Mercury (Hg)	0.005	0.009	0.040	0.020
Nickel (Ni)	8.6	11.0	2.7	2.1
Silver (Ag)	0.7	ND	0.20	ND
Thallium (Tl)	ND	ND	0.10	ND
Zinc (Zn)	14.0	40.0	280.0	150.0

Figure 1-8

Results of CDM's Surface Soil Sampling

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sources and limitations they could impose on future uses of the undeveloped middle area of the site. These areas do not appear to pose any imminent threat of adverse health or environmental impacts from volatilization, direct contact or surface runoff exposures given the current condition and use of the site. If the potential impacts from these areas warrant remedial action, the likely alternatives are to pave over them or to excavate them. In the latter case, on-site land treatment of the excavated soils could be a very attractive disposal option, given the site's climate, hydrogeologic characteristics and current use (i.e., undeveloped in the middle, trucking operations at both ends).

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The potential for significant soil contamination in former processing areas from spills and leaks is not a major concern because these areas have largely been paved over. Such contamination can only pose potentially significant impacts as continued sources of groundwater contamination, which is addressed below. The proposed RI/FS work plan does include an effort to map carefully former processing areas against currently paved areas to verify that the former are indeed currently covered.

The proposed RI/FS work plan does not address the potential for soil contamination in the undeveloped portion of the site. This is because the nature of former operations in this area (storage of treated and untreated wood), careful visual inspection of the site, historic aerial photos, and preliminary work by CDM in this area all indicate that no significant contamination is expected. There may be small pockets of minor contamination from former drainage swales or treated wood drippage, but the impacts of such areas should be negligble given current and likely future site uses and the fact that groundwater impacts of the site as a whole will be separately addressed.

2. <u>Groundwater Contamination</u>

The very limited groundwater sampling work conducted by CDM indicates that portions of the shallow sand unit (stratum III) has probably been contaminated by former operations at the site.

Monitoring well CAV-OW-02 located in or immediately downgradient of the suspected pond (Area 2) showed over 17 ppm total PAH (mainly naphthalene) and well CAV-OW-01 near Area 4 and the former tar products plant showed about 1 ppm total PAH (Figures 1-4 and 1-6). The extent of groundwater contamination is unknown, however, as other shallow wells were not sampled. It is possible that it extends off-site, however, since the gradient indicated by CDM's water level data (about 0.004 ft/ft -- see Figure 1-4) and a conservatively assumed conductivity of 10^{-3} cm/sec yield a groundwater flow rate of about 15 feet/year (at 30% porosity), or about 450 feet in 30 years. This would place a plume from Area 2 just about at the western edge of the site. It could extend further, of course, if the conductivity is higher than assumed above. It is also likely that there is shallow groundwater contamination at the southern end of the site resulting from spills and leaks in the former processing area (note visual signs of contamination at CAV-OW-10 -- Figure 1-6) and that this contamination has migrated off-site, possibly across Collingsworth Street. In any case, it is expected that only the lower molecular weight PAH compounds have migrated to any significant extent, since groundwater transport of higher molecular weight PAH (4+ ring compounds) tends to be strongly attenuated by adsorption.

Contamination of deeper aquifers underlying the site is not expected. The deep well installed by CDM in a sand unit about 160 feet deep (CAV-OW-6) showed no evidence of contamination by wood treating wastes. None would be expected, since vertical migration of contaminants from the shallow sand at 10-20 feet deep through 140 feet of interbedded clay, sandy silt, and silty sand layers, consisting mainly of clay layers (about 100 feet), would take a very long time (probably many centuries).

It is unclear if contamination of the shallow sand unit will pose sufficient impacts to warrant remedial action. There are no known users of this aquifer and it is likely to have been contaminated by a variety of sources, given its location as the surficial aquifer in an urban/industrial area. There may be concerns with discharges of contaminants from the aquifer to bayous in the area, but such bayous are relatively far from the site and are likely to exhibit moderate contamination already, given their urban character. If remedial action is warranted, it would clearly be limited to gradient control or pump-out wells or drains, since source control actions would be ineffective (i.e., contaminated groundwater would still exist even if the source(s) was removed) and/or infeasible (i.e., removing any source materials in the now paved former processing area).

In light of the above assessment, the proposed RI/FS work plan is aimed at determining the magnitude and extent of shallow groundwater contamination and confirming the lack of contamination in deeper aquifers. Sufficient data will be obtained to assess the impacts of shallow groundwater contamination, determine if remedial action is justified, and, if so, evaluate alternative remedial actions.

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PROJECT APPROACH

Before alternatives for remedial actions can be finally determined, there must be suffucient information available to fully develop, screen and evaluate those alternatives. A Remedial Investigation/Feasibility Study (RI/FS) is performed to gather the pertinent information. A preliminary assessment of probable site impacts and likely feasible remedial action alternatives was performed by Koppers Co. Inc. and ERT based on the available site specific data. This preliminary assessment, which is summarized in the preceding section, provided the basis for the proposed RI/FS work plan described below.

In addition to providing the necessary data to assess feasible actions, the RI/FS tasks are structured to accomplish the following:

- Determine the nature and extent of contamination at the site.
- Define the pathways of migration from the site, as well as the impact of contaminants on potential receptors.
- Define on-site physical features and facilities that could affect contaminant migration and clean-up.
- Evaluate the specific hazards present at the site based on data from remedial investigations.

Although there currently is a significant amount of data and information on the former Cavalcade plant site, there are a sufficient number of data gaps to preclude the selection, screening and evaluation of remedial action at this time. Existing data indicate some degree of soil and groundwater contamination at the site. Surface water contamination impacts appear to be negligible. The isolated areas of soil contamination and the subsurface conditions which are impacting the groundwater quality and flow regime need to be documented more fully. Once the additional data are obtained, the following tasks will be performed:

- Develop and evaluate remedial action alternatives.
- From the alternatives, recommend the most cost-effective remedial action(s) for the site.
- Prepared a conceptual design for the recommended remedial action(s).

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The scope of work for an RI/FS includes ten general activities, each having several well-defined tasks. These activities are:

- Preparation of work plan (Task 1.1).
- Site definition/waste characterization activities (Task 1.2).
- Detailed site characterization studies (Task 1.3).
- Endangerment assessment (Task 1.4).
- Remedial investigation report (Task 1.5).
- Evaluation of remedial action alternatives (Task 2.1).
- Alternative remedial action feasibility report (Task 2.2).
- Conceptual design (Task 2.3).
- Project management (Tasks 1.6 and 2.4).
- Community relations (Task 1.7).

The following sections describe a proposed work plan to accomplish the above activities. At certain points during the RI/FS, submissions will be made on work activities by Koppers (and/or its contractor) for review and approval by the U.S. EPA.

Task 1.1 - Investigation Support

The goal of this activity is to define the scope of work for the RI/FS and to develop a schedule and work plan to implement the recommended scope of the investigations. Additionally, this activity includes preliminary tasks that are necessary before conducting the actual site investigations and feasibility studies.

A. Subtask 1.1.1 - Assemble Project Team

Upon receipt of approval of the proposed RI/FS plan, the project team will be assembled. An initial meeting between the U.S. EPA, Koppers, and Koppers' consultant(s) will be held at the site. The objectives of this meeting will be to:

- o Introduce team members.
- o Discuss overall project objectives and approach.
- o Reconnaissance of the site.
- o Discuss potential sensitive issues.
- o Establish channels of communication and reporting.
- o Determine approximate sampling and well locations.

B. Subtask 1.1.2 - Prepare Quality Assurance Project Plan

A site specific Quality Assurance Project Plan (QAPP) will be developed. The plan will include both general and site-specific needs for the work assignment and will comply with the U.S. EPA's "Interim Guidelines and Specifications for Preparing Quality Assurance Plans" (QAMS - 005/80). Five copies of the draft QAPP will be provided to the U.S. EPA for review and comment. Upon receipt of written review comments, the draft QAPP will be revised by Koppers and/or its contractor. The draft QAPP will be approved and finalized if it is acceptable to the U.S. EPA.

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C. Subtask 1.1.3 - Site Health & Safety Plan

A site health and safety assessment will be conducted to determine if there are portions of the site that present potentially hazardous chemical exposure levels in the air, through dermal contact or through dangerous physical features. In conducting the assessment, available information on the site will be examined and reviewed to identify potentially hazardous areas. Such information will be used in selecting and implementing actions that will provide local residents and site investigators with adequate warning and safeguards. Input from Koppers industrial hygenists and environmental staff will assist in the development of the site health and safety plan. The plan will specify the field tests to be performed and the protective gear to be worn by site visitors and investigators. The plan will focus on the use of personal protective equipment that will be used to minimize exposure to hazardous materials through inhalation or direct contact when performing RI/FS work on or near the site. Five copies of the site health and safety plan will be submitted to the U.S. EPA.

D. Subtask 1.1.4 - Identify Preliminary Goals and Objectives

Preliminary goals and objectives for the Cavalcade RI/FS work plan have been discussed and agreed upon by Koppers and ERT, as summarized in Section D of the Introduction. The intent was to help in targeting the scope of the investigations described in this proposed RI/FS work plan by identifying likely site impacts and potentially feasible remedial actions. The discussions encompassed observations from site visits conducted by Koppers, conclusions drawn from existing site studies and reports on the site, and the collective experience of Koppers and ERT at other wood treating plant sites. These preliminary goals and objectives, after comment by the U.S. EPA, will be incorporated into the final RI/FS work plan for the Cavalcade site (subtask 1.1.6).

E. Subtask 1.1.5 - Sampling Plan

A draft proposed sampling plan has been prepared for inclusion in the final QAPP. Details of this plan can be found in Appendix A. This plan covers the sampling effort described later in this work plan and addresses the following specific topics:

- sample types and locations
- sampling equipment and procedures
- sampling QA/QC
- sample handling, custody procedures, and preservation
- sample documentation
- sample shipping
- analytical arrangements
- analytical procedures.

Five copies of the final proposed sampling plan will be provided to the U.S. EPA for review and comment. Upon receipt of written review comments, the sampling plan will be revised and, when approved by the U.S. EPA, it will be incorporated into the QAPP.

F. Subtask 1.1.6 - Work Plan

A final work plan will be prepared based on information obtained in Subtasks 1.1.1 through 1.1.5 and will include U.S. EPA comments on these and other tasks detailed in the proposed RI/FS work plan. The final plan will address all those activities necessary to gather the data required to evaluate remedial actions.

Task 1.2 - Site Definition/Waste Characterization Activities

This activity will define the physical characteristics of the site, both from historical and present-day perspectives. Boundaries of the site will be established. Historical records will be used to establish and characterize potential site contaminants.

A. Subtask 1.2.1 - Additional Data Gathering

A data search will be performed to compile available site information. A search will be made for additional site maps and historic aerial photographs. Relevant data and reports on geologic, soils, surface water and groundwater characteristics will be collected. Particular attention here will focus on the extent, use and possible other contamination sources for the shallow sand aquifer. Available information on previous site sampling and testing will be compiled and summarized. Sources of testing data include U.S. EPA, Texas Department of Water Resources (TDWR), and Koppers Co., Inc. The summary will include the dates and locations of samples, sampling and testing procedures used (if available), the organization that performed the testing and an evaluation of testing results. Koppers Co., Inc. files will be checked and/or personnel familiar with the former Cavalcade plant operations will be interviewed to identify the type(s) of wood preservatives and operations that were used at the site. Much of the work required by this subtask is already underway.

B. Subtask 1.2.2 - Site Mapping

An accurate map at a scale of 1"=100' has already been produced by McClelland Engineering for the former Cavalcade plant site. This map will serve as a site plan showing all pertinent plannimetric features upon which additional information can be plotted. Locations of all existing or proposed monitoring wells and soil borings will be indicated on this site map. Typical features and/or facilities which will be located on the map include, but are not limited to: each trucking firms structures, parking lots, etc., drainage ditches, Houston Belt and Terminal rail lines, old structures from Koppers

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operations and Koppers' old property boundaries. Through the use of old plant maps, the locations of plant processing areas and equipment will be determined so that a comparison to presently paved areas can be made. A legal description of the property(ies) will be researched and field-verified. The intent is to confirm property boundaries so that ownership will be known for properties being affected by subsequent remedial investigations and actions.

Task 1.3 - Site Characterization Activities

The goal of this task is to obtain the contaminant and site physical data required to evaluate potentially feasible remedial actions. The following subtasks are recommended for the site characterization and will supplement the existing contaminant study prepared by Camp Dresser & McKee:

- o Hydrogeologic investigation
- o Groundwater sampling and analysis
- o Soil sampling and analysis

The objectives of the site characterization studies will be to:

- o Define the horizontal and vertical migration of contaminants in the shallow groundwater.
- o Confirm the absence of detectable contamination in the deep, domestically used aquifer.
- o Define the chemical character of the contaminant plume(s).
- o Assess how site geology affects any contaminant migration.
- o Determine the extent and severity of soil contamination.

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A draft proposed sampling plan (Appendix A) has been developed to address the above objectives and is summarized below. The data from the sampling programs will be of enforcement quality consistent with chain-of-custody procedures.

A. Subtask 1.3.1 - Hydrogeologic Investigation

A second phase hydrogeologic study will be performed to further evaluate the subsurface geology and to confirm previously measured groundwater flow patterns. This information is required to determine:

- The horizontal and vertical extent of any contaminant plume(s) that may be present in the shallow groundwater, including a determination of potential offsite migration.

- The ability of the clay layers of Stratum IV to confine and prevent pollution migration.

- Shallow aquifer (Stratum III) characteristics pertinent to design and implementation of potential remedial actions.

The hydrogeologic investigation will consist of groundwater monitoring well installation, water level measurements and permeability testing.

1. Subtask 1.3.1A - Drilling and Well Installation Program

Groundwater monitoring wells will be installed at the eight tentative locations shown in Figure 1-9. All of the wells will be developed in the sand unit of the shallow groundwater aquifer. These wells will supplement the eight existing shallow wells installed by Camp Dresser & McKee on the Koppers site. The shallow wells will be installed to a depth such that eight feet of well screen will be placed below the expected water table and two feet above the water table.

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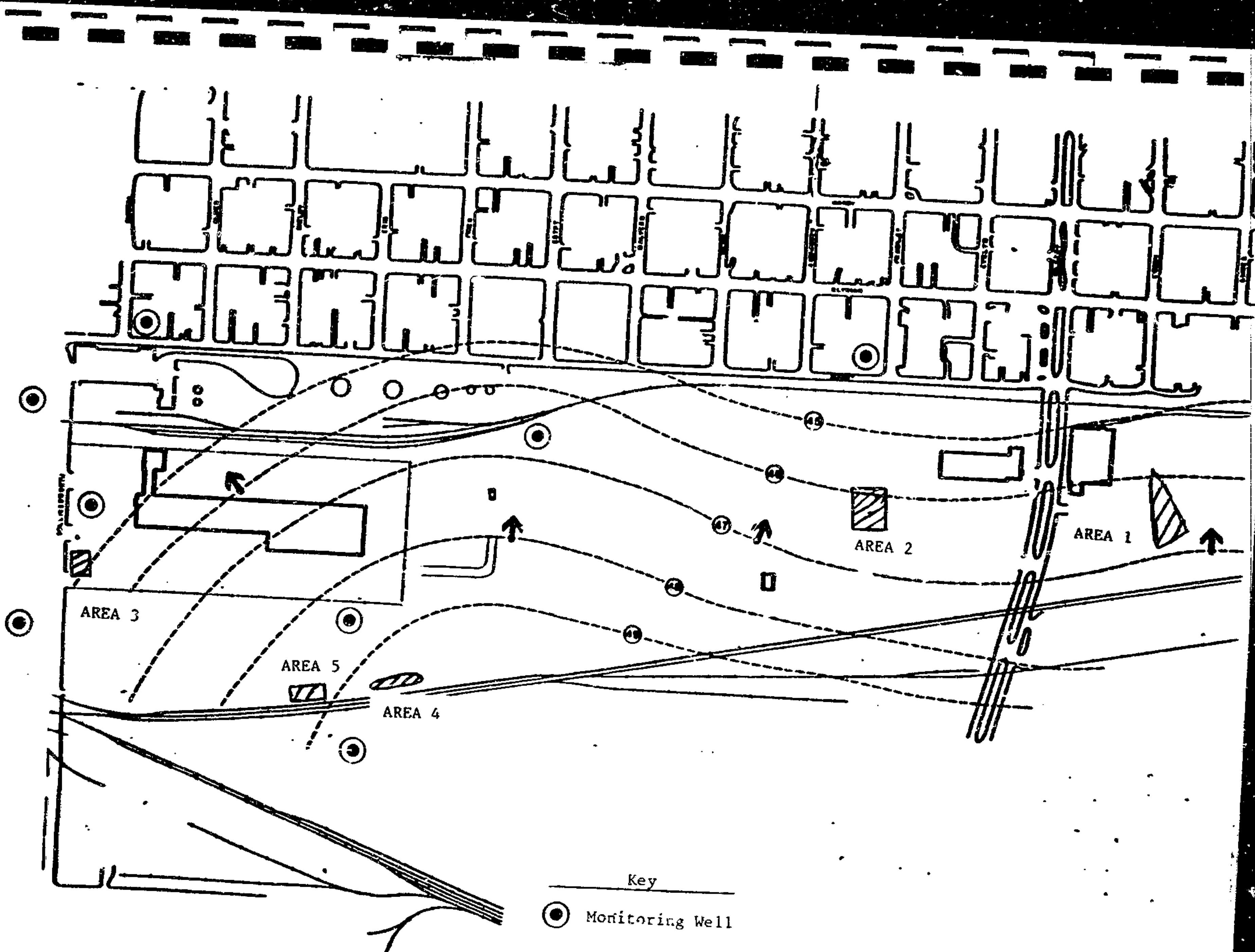

Figure 1-9. Proposed Monitoring Well Locations

All well drilling and installations will be supervised and logged by a qualified hydrogeologist or hydrogeologic technician. Procedures will include:

- The steam cleaning of all drilling equipment, tools and materials at the discretion of the supervising field geologist.
- Advancing of all boreholes using a hollow-stem auger rig to facilitate sampling and well installation.
- The eight shallow monitoring wells will be installed by recompleting soil boreholes identified in Subtask 1.3.1A. Refer to this subtask for descriptions of soil sampling and analytical work.
- All soil samples will be field-inspected for visual contamination. All soil samples will be visually classified in the field.

All monitoring wells will be constructed of two-inch ID flush-threaded PVC casing with a ten-foot section of manufactured well screen. The annular space between the well and borehole will be backfilled with coarse sand or fine gravel to serve as a formation stabilizer, which will extend three feet above the top of the screen. A bentonite seal will be placed above the formation stabilizer and the annulus will be sealed to the surface with cement and bentonite grout. A locking, protective standpipe will be installed over the well standpipe, which is embedded in a concrete pad. Figure 1-10 displays the generalized monitoring well construction details. All monitoring wells will be developed after installation by purging the wells until the discharge water is clear. This will improve the well efficiency and remove deleterious foreign matter which may have been introduced during the drilling. Two sampling rounds will be conducted for all of the monitoring wells.

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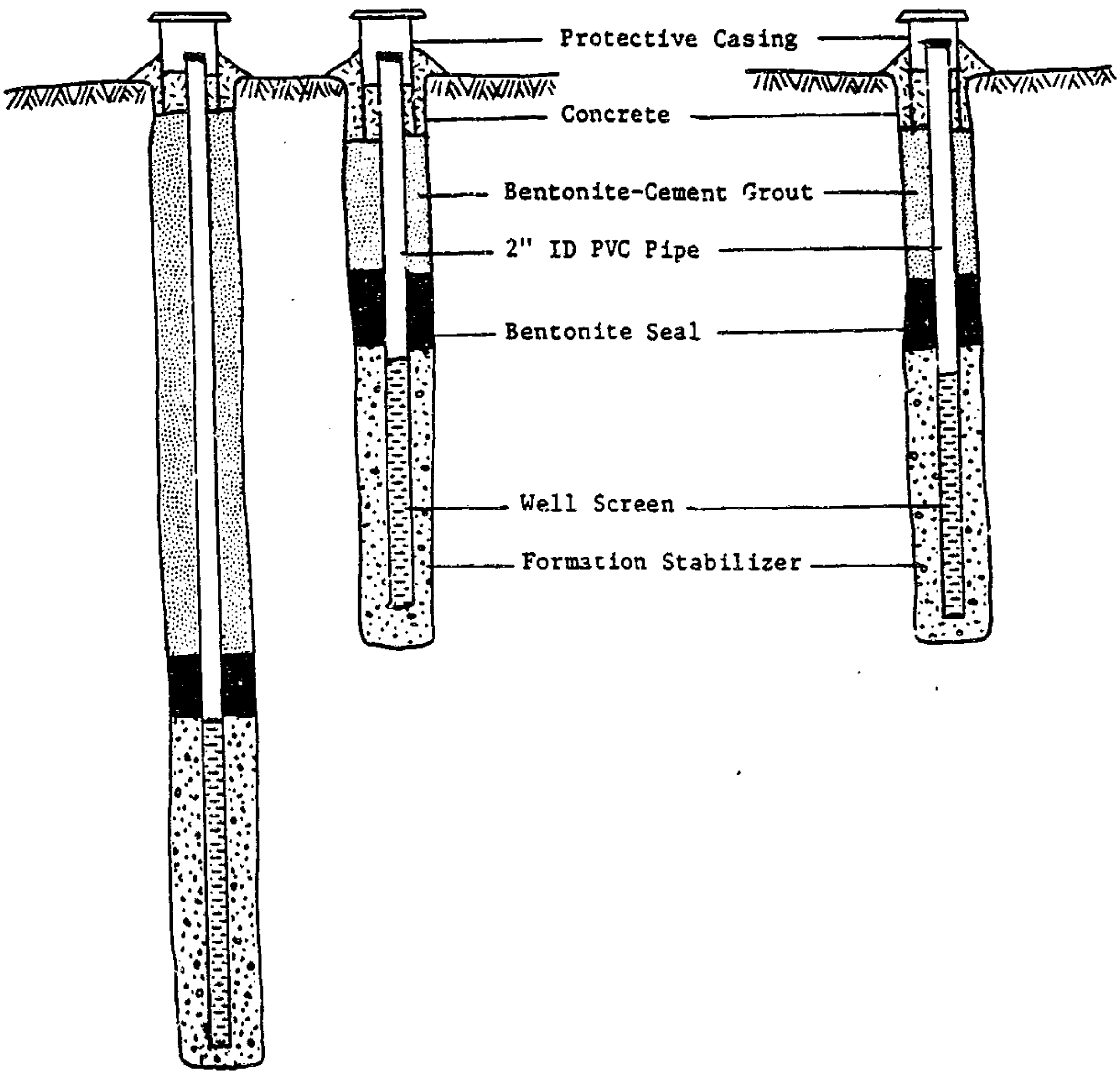

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FIGURE 1-10

WELL CONSTRUCTION DETAILS

A technical memorandum will be prepared to provide documentation of hydrogeologic data obtained during the drilling and well installation activity. This memorandum will include hydrogeologic profiles, laboratory test results of soil samples, boring logs, well installation details and a discussion of the hydrogeologic conditions at the site.

2. Subtask 1.3.1B - Permeability Testing

Single-well permeability tests will be conducted at four of the monitoring wells installed under subtask 1.3.1A. These tests will use the falling head, rising head or constant head method, depending on the site-specific conditions encountered and the supervising field geologist's judgement. A technical memorandum summarizing the results will be prepared.

3. Subtask 1.3.1C - Water Level Data

Water levels will be measured quarterly in all of the wells installed under subtask 1.3.1A and in all existing CDM-installed wells using a steel tape. Water levels will also be measured whenever wells are sampled, which may also satisfy the quarterly requirement. Results of each water level measuring round will be summarized in technical memoranda. Water level measurements have already begun on-site in existing CDM wells by Koppers' consultants.

B. Subtask 1.3.2 - Groundwater Sampling and Analysis

Following the installation, development and stabilization of the monitoring wells, a groundwater sampling and analysis program will be conducted. The program will provide groundwater quality data that will help further define the vertical and horizontal extent of the containment plume(s) both on and offsite.

Immediately before the collection of any groundwater samples, three casing volumes of water will be removed from each well. All groundwater samples will be analyzed for the following parameters:

- pH
- Specific Conductivity
- Total organic carbon
- Chemical oxygen demand
- Phenols
- Total dissolved solids
- Zinc
- Chromium
- Arsenic
- Copper
- Pentachlorophenol
- Naphthalene

Selected samples (at least six from each sampling round) will be analyzed for PAH by EPA Method 610.

This task will consist of the collection of two sets of samples from each of the 16 ground-water monitoring wells and the single deep well (CAV-OW-06). The two sets of samples will be obtained on two separate sampling occasions with approximately four weeks between sampling rounds. A collection of a third round of samples may be necessary if results from the first two rounds are contradictory or inconclusive. Technical memoranda summarizing each sampling effort will be prepared.

C. Subtask 1.3.3 - Soil Sampling and Analysis

The Camp Dresser & McKee contaminant investigation identified three areas as potential sources of groundwater contamination. These areas are located as shown on Figure 1-4. The purpose of this program is as follows:

- To determine the vertical and horizontal extent of the suspected contamination source in the vicinity of monitoring well CAV-OW-02. (Identified as Area 2).
- To determine the vertical and horizontal extent of the suspected contamination source south of monitoring well CAV-OW-01 (Identified as Area 4).
- To determine the vertical and horizontal extent of the suspected contamination source north of well CAV-OW-11 (Identified as Area 5).

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- To visually identify the limits of the contamination and to chemically identify the contaminants.

This will be accomplished by digging a series of test pits in these areas (see Figure 1-11) for careful visual inspection and selected sampling and analysis. The exact locations and depths of the pits will be finalized during the site visit (see Subtask 1.1.1). All test pits are to be backfilled to original grade after a final inspection determines that all appropriate and/or required data and samples have been collected.

Representative soil samples from each test pit will be taken and chemically analyzed and physical characteristics determined. These analyses will be as follows:

- Total Extractable Hydrocarbons
- Extraction/IR Analysis
- Polynuclear Aromatic Hydrocarbons
- Total Organic Carbon
- Total Kjeldahl Nitrogen
- Phenols
- Electrical Conductivity
- Grain Size
- Permeability
- Atterberg Limits
- RCRA EP Toxicity
- pH
- ICAP Metals

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This complete list of analyses will not be performed on every sample. The intent is to use a hierarchy of tests, ranging from simple screening tests for the largest number of samples (e.g., benzene extractables, phenols) to more detailed and expensive tests for a selected few samples (e.g., PAH, RCRA, EP toxicity). The screening tests are intended primarily as a means to add quantitative correlation with visual observations, with the more detailed tests providing data for the endangerment assessment and evaluation of potential remedial actions. Many of the tests are intended to provide necessary data for evaluating on-site land treatment as a means of disposing of contaminated soil (e.g., TOC, TKN, conductivity, grain size, pH).

A technical memorandum will be prepared discussing the field work and observations from the test pit program. An additional technical memorandum will be prepared detailing the results of all soil analyses. This memorandum will summarize all technical aspects of

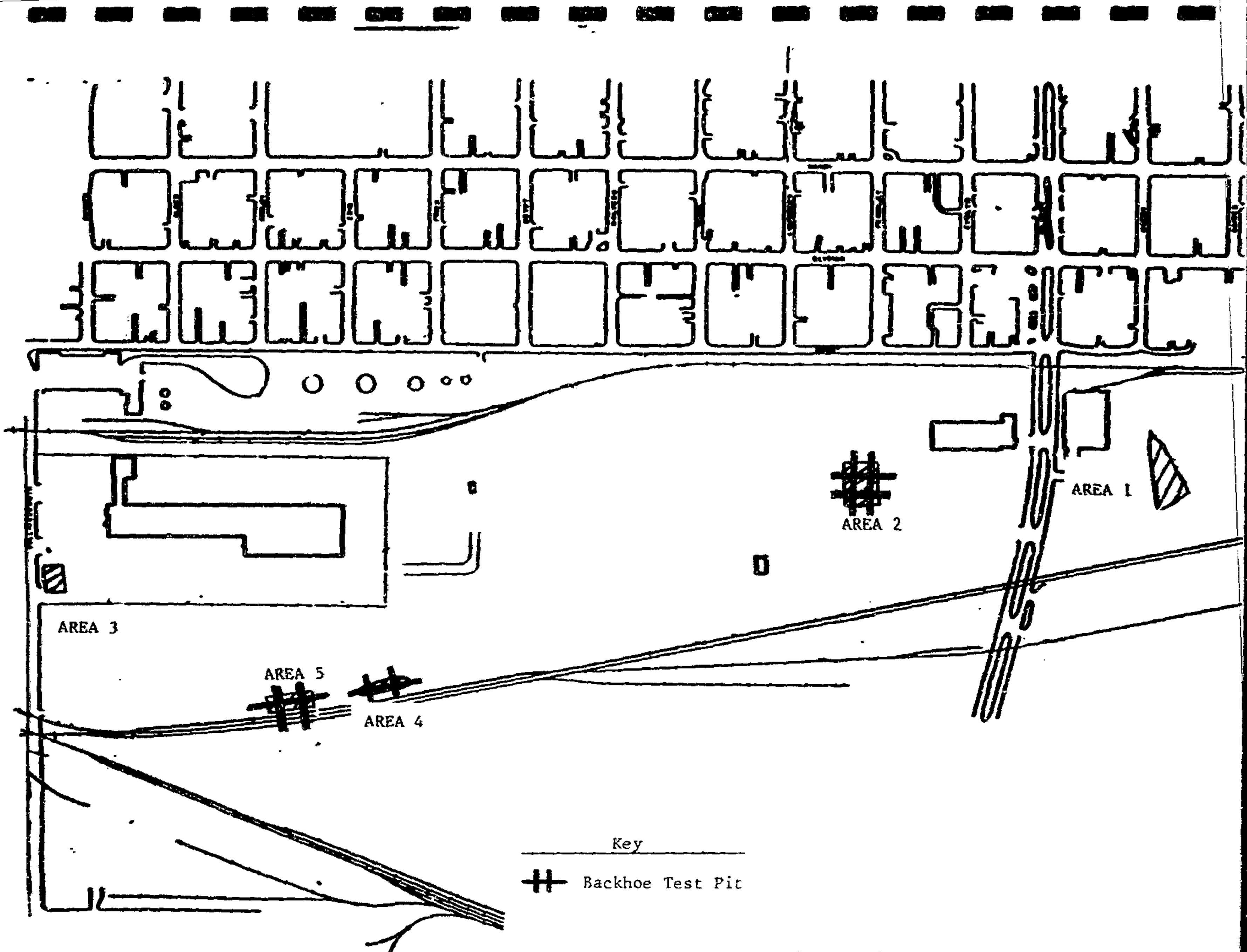

Figure 1-11. Proposed Backhoe Test Pit Locations

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this test program and include, but not be limited to; identification of the vertical and horizontal extent of visual contamination, contaminant concentrations in the soil, and estimates of contaminated soil volumes.

Task 1.4 - Endangerment Assessment

All data collected during Task 1.3 will be evaluated to determine if the site poses a danger to public health, welfare, or the environment. Existing standards and criteria will be reviewed to formulate conclusions and recommendations regarding the site. A technical memorandum will be prepared summarizing the evaluation process and presenting the results of the endangerment assessment. At a minimum the endangerment assessment will:

- o Define the populations which may be potentially exposed to the contaminants.
- o Evaluate exposure routes (e.g., direct contact, ingestion) for the exposed populations.
- o Based on contaminant concentrations and contaminant properties (e.g., volatilization, adsorption), evaluate possible exposure levels via each exposure route.
- o Based on current standards and health effects criteria (e.g., Ambient Water Quality Criteria, NIOSH standards), evaluate exposure levels with respect to documented, acceptable levels.

Five copies of the endangerment assessment technical memorandum will be distributed to the U.S. EPA for review and comment.

Task 1.5 - Remedial Investigation Report

A draft remedial investigation report will be prepared to consolidate and summarize the data obtained and documented in technical memoranda prepared during each task. The draft report will

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include recommendations whether or not to proceed with the evaluation of remedial action alternatives. The draft remedial investigation report will be submitted by Koppers to the U.S. EPA for review. A review meeting will be held with the U.S. EPA to discuss the contents of the remedial investigation report. Review comments will be incorporated into the final report and submitted to the U.S. EPA for approval.

Task 1.6 - Remedial Investigation Project Management

This activity will occur throughout the remedial investigation by Koppers and/or its contractor. General tasks will include establishment of project records; review meetings with the U.S. EPA; preparation of monthly reports; ongoing monitoring of staffing, budgets, schedule and subcontractor performance; and maintaining quality assurance programs.

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Task 1.7 - Community Relations Support

It is assumed that the U.S. EPA will take the lead community relations role at the Cavalcade site. Koppers and/or its contractor will provide assistance to the U.S. EPA when so asked. Such assistance might consist of providing selected individuals to speak at meeting and preparing public meeting materials, project updates, technical summaries, and public notices. Examples of these activities are provided below:

- o Public Meeting Materials - Assist in preparing slide shows, graphics, and presentation materials for the public meetings.
- o Project Updates - Provide assistance in preparing project updates for distribution by the U.S. EPA to the general public.
- o Technical Summaries - Prepare brief technical summaries. These will be distributed to the general public.

- o Public Notices - Prepare public notices and small display adds to announce each public meeting.

No activities will be started without specific instructions from the U.S. EPA.

Task 2.1 - Evaluation of Remedial Action Alternatives

This activity will evaluate alternative remedial actions on the basis of economic, environmental and engineering criteria. It will select an alternative or combination of alternatives for conceptual design and implementation.

A. Subtask 2.1.1 - Develop Potential Remedial Alternatives

A set of potential remedial actions will be defined and developed based on data acquired during the remedial investigation. Site-specific criteria and limitations will be evaluated with respect to all potential remedial action(s). The no action alternative will be included in the evaluation as a baseline alternative.

B. Subtask 2.1.2 - Screen Alternatives

Screening criteria will be prepared and used to assess the remedial action alternative(s). The results of the Endangerment Assessment will play an important role in developing the screening criteria. Other factors which will be addressed in developing the screening criteria include:

1. Economic

Order-of-magnitude capital and long-term operational and maintenance (O&M) costs will be estimated and a present worth value determined for cost comparison of alternatives.

2. Environmental Effects

The adverse impacts of the alternatives, the adequacy of the source control, and the acceptable mitigation of danger to public health, welfare and the environment will be identified. The Endangerment Assessment will be particularly useful in this area.

3. Engineering

The alternative must be technically feasible regarding site location and conditions. It must be applicable to the project needs, and it must be a reliable method of solving the problem.

C. Subtask 2.1.3 - Additional Engineering Studies

After screening the remedial action alternatives for further evaluation, Koppers and/or its contractor will evaluate the field investigation studies completed during the remedial investigation. Any additional engineering studies that may be required to fully evaluate the cost, feasibility, applicability, or reliability of any alternative will be identified and defined for U.S. EPA review and approval. It is assumed that sufficient review and analysis of each task in the remedial investigation will be undertaken so that any additional engineering data which may be required will be identified during the remedial investigation field work. Little, if any, additional study is expected to be necessary at this point in the feasibility study process.

D. Subtask 2.1.4 - Refine Alternatives

After the screening process, the remedial actions which have been determined to be the most feasible will be refined and more fully developed. A detailed written description of each alternative, basic component diagrams for each alternative to be considered, major equipment needs and utility requirements, conceptual site layout drawings and a preliminary implementation schedule will be prepared.

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E. Subtask 2.1.5 - Economic Assessment

Construction and O&M costs will be estimated for the most feasible remedial action alternatives. The cost estimates prepared for this task will be aimed at ±50% accuracy. After completion of the cost estimate, a present-worth analysis will be conducted.

F. Subtask 2.1.6 - Environmental Assessment

The alternatives will be evaluated based on the environmental screening criteria developed. The comparative assessments will determine:

1. The adverse environmental impacts of the alternatives;
2. The effectiveness of adverse impact mitigation measures;
3. The adequacy of source control measures;
4. The effectiveness of off-site control measures;
5. The publc acceptability of the alternative; and
6. The institutional and legal (e.g., environmental permits) constraints.

G. Subtask 2.1.7 - Engineering Assessment

The engineering aspects of the alternatives will be assessed on the basis of acceptable engineering practices. The specific factors to be evaluated include:

1. Reliability;
2. Established technology;
3. Suitability to control the problem;
4. Risks to construction and operational personnel health and safety;
5. Constructability and operability with respect to site conditions;
6. Maintainability and sensitivity to off-site upset; and
7. Off-site transportation and disposal capacity requirements.

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H. Subtask 2.1.8 - Comparative Ranking of Alternatives

During this task, the assessments will be compiled, the alternatives ranked within each assessment category, and overall rankings prepared. This ranking will be based on the professional judgement of Koppers and/or its contractor staff, and will reflect U.S. EPA input.

I. Subtask 2.1.9 - Comparative Ranking Review Meeting

A review meeting will be held to solicit input into the comparative ranking of the remedial action alternatives. The review meetings will include U.S. EPA personnel.

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Task 2.2 - Feasibility Study Report

A. Subtask 2.2.1 - Draft Report

A preliminary draft report will be prepared for agency review on the various alternative actions studied. A draft report will be prepared summarizing the screening and review process. This draft Feasibility Study Report will be submitted to the U.S. EPA for review and comment.

A community relations meeting may be held focusing on a clear description of the problem, advantages and disadvantages of each alternative and its relative ranking. Technical questions by the public could be answered at such a forum.

B. Subtask 2.2.2 - Final Report

Following receipt of review comments and approval of the recommended remedial actions, the final Feasibility Study report will be submitted. The final report will incorporate the review comments and document the U.S. EPA decision process.

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Task 2.3 - Conceptual Design

The conceptual design activity will be the mechanism by which the selected remedial alternative(s) will be defined. The following scope of work addresses the conceptual design requirements, and provides additional data that will be needed to prepare a design consistent with the objectives of the proposed remedial actions. It is intended to be sufficient to allow preparation for a ±25% level cost estimate.

A. Subtask 2.3.1 - Preparation of Conceptual Design Elements

The following conceptual design elements will be developed as required for the remedial actions selected:

1. A conceptual plan view drawing of the overall site, showing general locations for project actions and facilities;

2. Conceptual layouts (plan and cross sectional views where required) for the individual facilities, other items to be installed or actions to be implemented;

3. Conceptual design criteria and rationale;

4. A description of types equipment required, including approximate capacity, size and materials of construction;

5. Process flow sheets and a description of the process;

6. A description of structural concepts for facilities;

7. Utility requirements and rationale;

8. An evaluation of potential construction problems, associated risks and the proposed solutions;

9. Right-of-way requirements;

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10. A description of technical requirements for environmental mitigation measures;

11. Additional engineering data required to proceed with the design;

12. Construction permit requirements;

13. Closure and long-term monitoring requirements and rationale;

14. Performance standards to define what levels of cleanup will be required to complete the remedial action;

15. Order-of-magnitude implementation cost estimate;

16. Order-of-magnitude annual O&M cost estimates and duration of operating expenses; and

17. Preliminary project schedule.

B. <u>Subtask 2.3.2 - Preparation of Draft Report</u>

A draft report summarizing conceptual design data and information will be prepared and five copies will be submitted for distribution to the U.S. EPA.

C. <u>Subtask 2.3.3 - Draft Report Review</u>

A draft report review meeting with the U.S. EPA will be held and review comments will be discussed.

D. <u>Subtask 2.3.4 - Preparation of Final Conceptual Design Report</u>

After receipt of written review comments, the draft report will be finalized and submitted to the U.S. EPA.

Task 2.4 - Feasibility Study Project Management

This activity occurs throughout the Feasibility Study. General tasks include establishment of project records; review meetings with the U.S. EPA; preparation of monthly reports; ongoing monitoring of staffing, budgets, schedule and subcontractor performance; and maintaining quality assurance programs.

PROJECT SCHEDULE

Table 3-1 presents the proposed schedule for the Texarkana site RI/FS work plan. The schedule calls for the Remedial Investigation to be completed in 40 weeks and the Feasibility Study to be completed in 26 weeks, for a total of 66 weeks. This schedule is generally based on 3 weeks for EPA review and approval where required. The schedule also assumes that two groundwater sampling rounds will be sufficient for the remedial investigation and that no major additional engineering studies will be required for the feasibility study.

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TABLE 3-1

RI/FS PROJECT SCHEDULE
KOPPERS CAVALCADE SITE

Item	Week Number of Completion
1) EPA approval of proposed RI/FS work plan	0
2) Task 1.1 - Investigation support	2
Assemble project team	
Prepare QAPP	
Prepare site health and safety plan	
3) Final RI/FS work plan is submitted to EPA and approved	5
4) Task 1.2 - Site definition/waste characterization activities	9
Additional data gathering	
Site mapping	
5) Task 1.3 - Site Characterization Activities	
Drilling and well installation	13
Backhoe test pit installation and sampling	13
Technical memoranda to EPA (hydrogeologic data and backhoe test pit data)	15
Permeability testing	17
First round groundwater sampling	17
Soil sampling analysis results	19
Technical memoranda to EPA (permeability testing, groundwater sampling, soil sample analytical results)	20
First round groundwater sampling analysis results	23
Technical memorandum to EPA (first round analytical results)	24
Second round groundwater sampling	25
Technical memoranda to EPA (second round groundwater sampling)	26
Second round groundwater sample analysis results	31
Technical memorandum to EPA (second round analytical results)	32
6) Task 1.4 - Endangerment Assessement	34
7) Task 1.5 - Draft remedial investigation report prepared and approved by EPA	36

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TABLE 3-1 (Cont'd)

Item	Week Number
8) Remedial investigation report review meeting with EPA	38
9) Final remedial investigation report submitted to EPA	40
10) Task 2.1 - Evaluation of remedial action alternatives	48
Develop potential remedial alternatives	
Develop screening criteria	
Refine alternatives	
Economic assessment	
Environmental assessment	
Engineering assessment	
Comparative ranking	
11) Comparative ranking review meeting with EPA	48
12) Task 2.2 - Feasibility study report	
Draft report submitted to EPA	51
Final report	56
13) Task 2.3 - Conceptual Design	
Preparation of conceptual design elements	
Preparation of draft report	
Draft reported submitted to EPA	64
14) Conceptual design draft report review meeting with EPA	66
15) Preparation of final conceptual design report	68

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APPENDIX A

PROPOSED SAMPLING PLAN

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PROPOSED SAMPLING PLAN
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
KOPPERS CO., INC.
FORMER CAVALCADE PLANT SITE, HOUSTON, TEXAS

1.0 OBJECTIVES

This sampling plan documents procedures and practices to be used in the performance of soil borings and monitoring well installations, and in obtaining samples of groundwater and soil at and around the Koppers Co., Inc. former Cavalcade plant site in Houston, Texas. Two sets of samples from seventeen (17) groundwater monitoring wells will be collected. In addition soil samples from backhoe test pits will be collected for chemical analyses. Soil samples from the test pits will also be tested for physical properties.

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2.0 SAMPLE LOCATIONS AND NUMBERS

2.1 Groundwater Samples

Groundwater samples will be collected from the 9 existing wells (8 shallow wells and 1 deep well) and the 8 proposed monitoring wells to be installed on the site. (Note that existing well CAV-OW-09 has been destroyed and must be replaced. Its replacement is considered to be a new, proposed well for sampling plan purposes). Figure 1 shows the approximate locations of the monitoring wells to be sampled. In addition to the 17 groundwater samples outlined above, duplicates will be taken at two wells during each sampling round. Two field blanks will also be collected during each sampling round. The blanks and duplicate samples will be filtered and preserved in the same manner as the other groundwater samples.

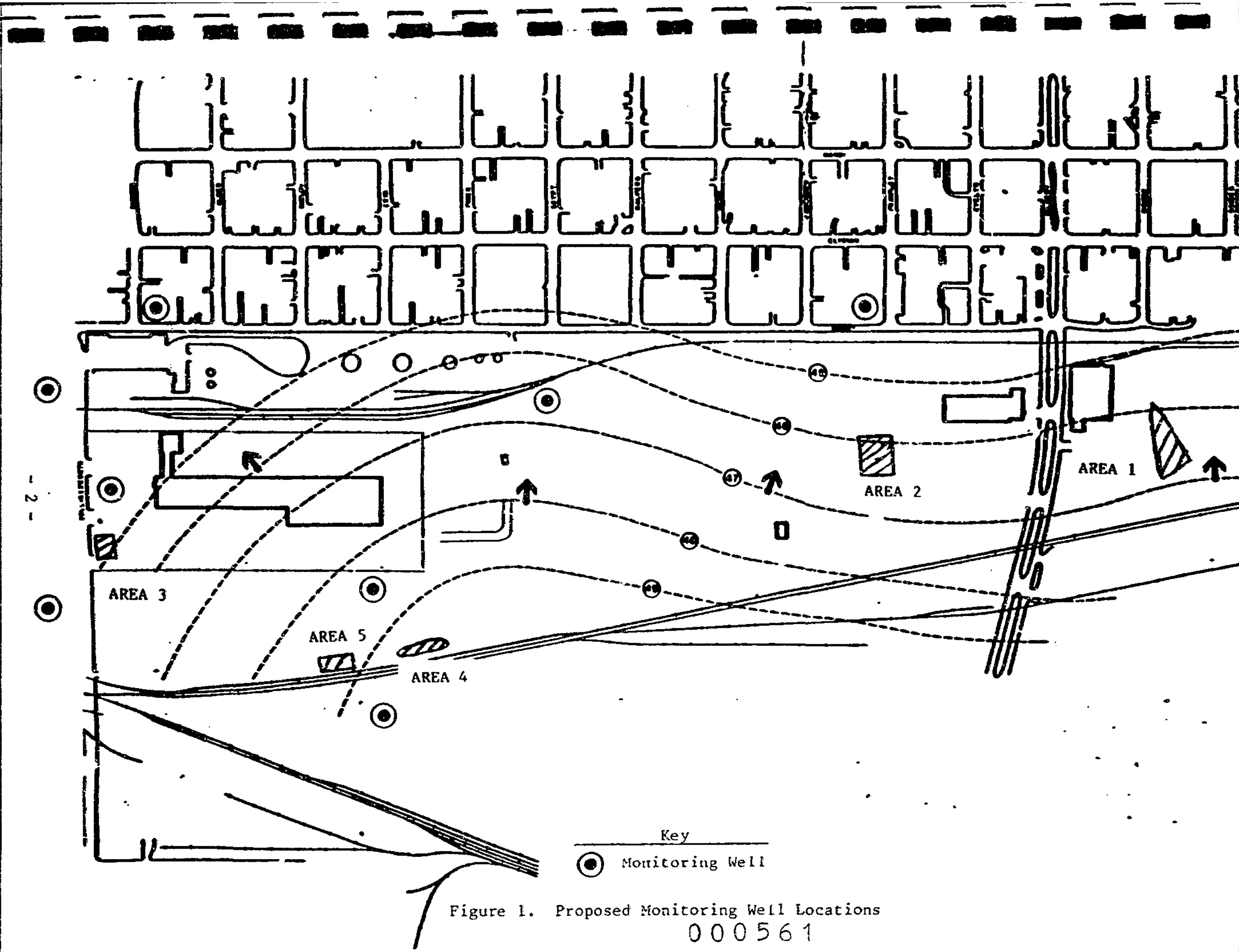

Figure 1. Proposed Monitoring Well Locations

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2.2 Soil Sampling

At all of the eight (8) proposed monitoring well locations, soil samples will be collected to the terminus of each borehole. The soil samples will be collected using a standard split spoon sampler at 2 1/2 foot intervals from 2 1/2 to 15 feet below ground surface and at 5-foot intervals thereafter.

At several well locations, 3-inch Shelby tubes will be collected of cohesive soils. The Shelby tube samples will be used for laboratory permeability testing. The remainder of the soil samples from the borings will be retained for visual classification using the Unified Soil Classification System.

From 20 to 40 grab samples of backhoe test pit soil samples will also be collected. The test pit soil will be collected for composite samples with a hand trowel from the vertical sides of the test pit at points where visual contamination is evident. The intent of the sampling program for chemical analysis of soil is to optimize detection of contaminated soils. Approximate test pit locations are shown in Figure 2.

From ten to twenty fine-grained (clay or silt) soil samples will be tested for Atterberg limits (ASTM test methods D-423 and D-424). Most of the fine-grained soil samples tested for Atterberg limits will be further tested for grain size distribution (ASTM test method D-422). Five to ten coarse-grained (sand or sand and gravel) soil samples will also be tested to determine grain size characteristics. Three of the Shelby tube samples will be used to run laboratory permeability tests.

Samples for physical testing will be selected by the following criteria. Some of the tested samples will be representative (based on visual observations) of the major soil types present on the site. Other samples will be tested where the visual classification indicates a soil is on the margin (i.e., close to another classification) of a soil type, to verify the classification.

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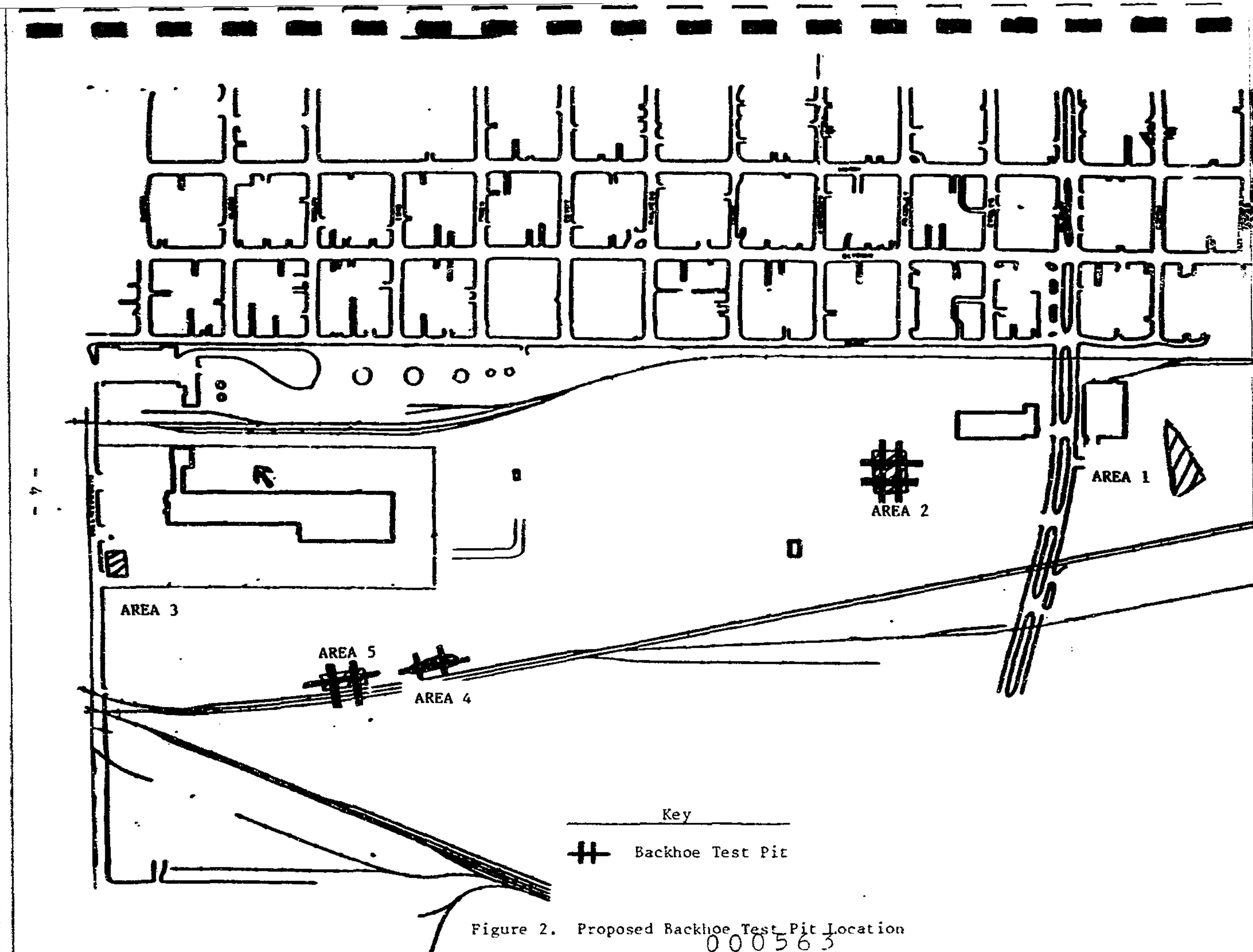

Figure 2. Proposed Backhoe Test Pit Location

3.0 SAMPLE DESIGNATION

A sample numbering system will be used to identify each sample for chemical analysis, including duplicates and blanks. A listing of the sample identification numbers will be maintained in the log book by the sampling team leader. Each sample number will be comprised of the three components as described below:

3.1 Project Identification

A two-letter designation will be used to identify the site where the sample was collected. For this project, it will be CV for the former Cavalcade plant site.

3.2 Sample Location

Each sample collected will be identified by a alpha-code corresponding to the sample type followed by the sample location number. The alpha-codes are as follows: MW - monitoring well; SB - soil boring; TP - test pit; FB - field blank. All sample locations will be numbered. The numerical designation of a location will be followed by the type of sample collected except for field blanks. Field blanks will have an FB followed by the alphacode for the type of blank (e.g., a monitoring well blank will be FBMW). All existing monitoring wells will be renumbered to conform to this sampling/location code.

3.3 Sample Identifier

All water samples will have a two-digit number as the last component of the sample identifier. The sampling events (rounds) will start with 01 and progress upwards. It is anticipated that two sampling rounds for groundwater will be sufficient, but additional rounds may be required.

All soil samples will also have a two-digit number as the last component of the sample identifier. These numbers will start at 01 and increase with depth at each sampling location (boring or test pit).

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3.4 Sample Number Examples

CV-MW06-02: former Koppers Cavalcade plant site; water sample round 2 from monitoring well 06.

CV-SB09-01: Former Koppers Cavalcade plant site; soil sample 1 from soil boring location 09 (depth to be noted in the log book).

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4.0 SAMPLING EQUIPMENT AND PROCEDURES

4.1 Drilling and Well Installation Program

Eight groundwater monitoring wells will be installed at the eight locations shown in Figure 1. At each of the eight locations, a monitoring well will monitor the shallow ground-water table.

All well drilling and installations will be supervised and logged by a hydrogeologist or a qualified hydrogeologic technician. Procedures will include:

1. The steam cleaning of all drilling equipment, tools and materials at the discretion of the supervising field geologist.

2. Advancing of all boreholes using a drill-rig-mounted hollow stem auger.

3. Collection of soil samples in each hole at each location using a standard split spoon sampler at 2 1/2-foot intervals from 2 1/2 feet to 15 feet and at 5-foot intervals thereafter.

4. Collection of one Shelby tube of the clay layer underlying the shallow sand unit at several locations for laboratory permeability testing. Three of the Shelby tubes will be used for permeability testing.

Each soil sample collected from the borehole will be visually field-inspected foı contamination. All soil samples will be visually classified in the field.

All monitoring wells will be constructed with 2-inch I.D. flush threaded PVC casing and PVC manufacturered well screens. The shallow water table wells will be installed with 10-foot manufactured 0.010-inch slotted screens such that 8 feet of screen will be below the expected water table depth and 2 feet of screen above the expected water table depth. All well construction material will be steam cleaned before construction of the well.

The annular space between the well and the borehole will be backfilled with coarse sand or fine gravel to 3 feet above the top of the well screen to serve as a formation stabilizer. A bentonite seal will be placed above the formation stabilizer and the annulus will be sealed to the surface with cement and bentonite grout. A locking protective stand pipe will be installed over the well stand pipe that is embedded in a concrete pad.

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4.2 Groundwater Sample Collection

Prior to purging each well for sampling, a water level measurement will be taken using a fiberglass or steel tape with a steel sounding device attached to the end. The sounding device makes a popping noise at the water table. The tape will then be used to measure the total depth of the well to verify well identification. All water purged from the wells will be released onsite.

Each well to be sampled will be purged immediately prior to sampling using either a stainless steel bailer, a peristaltic pump system, or other appropriate methods. Discharge water will be collected and measured so that a minimum of three casing volumes are removed prior to sample collection.

After purging of the well has been completed, the samples will be collected using laboratory-cleaned, dedicated stainless steel bailers. Approximately one-half volume of well water will be removed with a stainless steel bailer prior to the retention of the sample in sample containers.

4.4 Soil Sample Collection

Soil samples will be collected from test pits and soil borings. At the backhoe test pit locations, soil samples will be collected using a hand trowel, in locations to be determined by the sampling team leader. Test pit composite samples may be prepared from individual grab samples. Boring samples will be collected as described in section 4.1.

All equipment, including Shelby tubes, used to collect the samples at all soil sampling locatons will be decontaminated between samples.

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5.0 SAMPLE HANDLING AND ANALYSIS

5.1 Sample Preparation

All samples collected will immediately be placed on ice (if necessary to maintain a temperature of 4°C). The metals portion of the inorganic groundwater well samples will be filtered in the field as soon as possible after collection. The samples will be filtered through 0.45 micron filter paper using a pressure filtration device. All filtered portions of the sample will be preserved as appropriate immediately after filtration. All sample fractions will be preserved prior to shipment according to the procedures required by the analytical methods listed in section 5.2. All samples will be shipped to the Koppers Research Laboratory (Monroeville, PA) or a qualified contractor laboratory within 24 hours after collection.

5.2 Analytical Methods

Below is a listing of analytical methods to be used for the various sample types collected:

1. Soil Samples

o Total Extractable Hydrocarbons	
o Freon Extraction/Infrared Spectroscopy	Koppers Method A-1053B[1]
o ICAP Metals	EPA Methods 3010 & 6010[2]
o Total Organic Carbon	EPA Method 9060[2]
o Total Kjeldahl Nitrogen	
o Electrical Conductivity	
o Phenols	EPA Methods 3540 & 8040[2]
o Polynuclear Aromatic Hydrocarbons	EPA Methods 3540 & 8100[2]
o Grain Size	ASTM Method D-422
o Permeability	
o Atterberg Limits	ASTM Methods D-423 and D-424
o RCRA EP Toxicity	40 CFR Part 261 Appendix II
o pH	

2. Groundwater

o pH	EPA Method 150.1
o Specific Conductivity	EPA Method 120.1
o Chemical Oxygen Demand	EPA Method 410.2
o Zinc	EPA Method 289.1
o Chromium	EPA Method 218.2
o Arsenic	EPA Method 206.2
o Copper	EPA Method 220.2
o Pentachlorophenol	Koppers Method A-2056[1]
o Phenols	EPA Method 420.1
o Total Organic Carbon	EPA Method 415.1
o Polynuclear Aromatic Hydrocarbons	EPA Method 610
o Total Dissolved Solids	EPA Method 160.2
o Naphthalene	Koppers Method A-2060

All samples will be considered low to medium concentration samples, based on existing analytical data collected from the site.

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(1) Copies attached.
(2) Per U.S. EPA "Test Methods for Evaluating Solid Waste". 2nd ed. SW-846. July 1982.

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6.0 SAMPLE DOCUMENTATION

The sampling team will consist of two or three members. It is anticipated that there will be a need for only one sampling crew. One of the sampling crew team members will be the Team Leader. The team leader will complete all necessary paperwork, preparing samples for shipment and helping with the decontamination of sampling equipment.

All samples will be collected under chain-of-custody procedures. Standard paperwork including sample tags, traffic reports, chain-of-custody forms and custody seals for sample tracking and records, will be filled out. All pertinent information about the samples will be logged in the site log maintained by the Team Leader. This information will include sample time, location, tag numbers, designation and sampler. New readings, weather conditions and field modifications or decisions will also be recorded. The log book will be completed in ink. Photographs with the time, date, location and task description will also be noted in the log book.

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